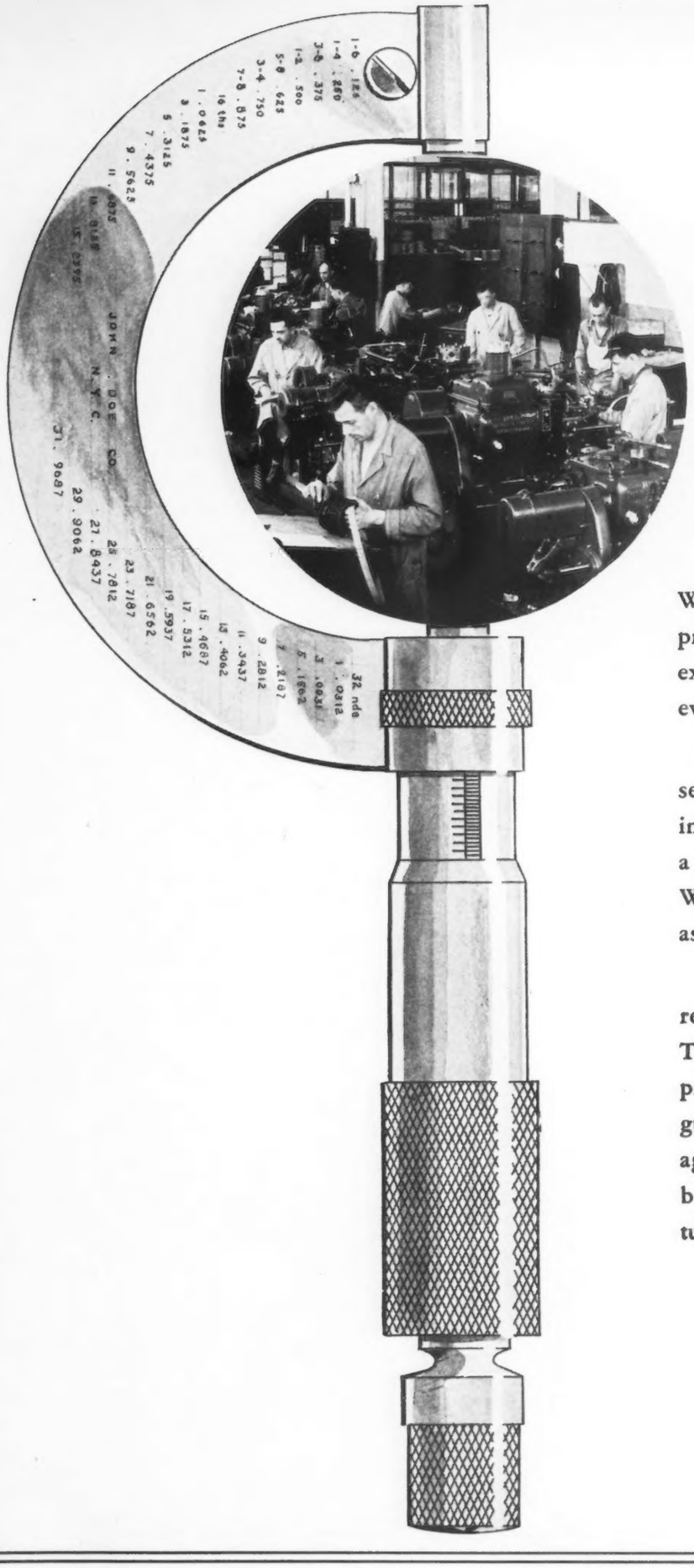

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DECEMBER 11, 1941
VOL. 148, NO. 24

This Week in . . . THE IRON AGE

Editorial

Technical Articles

Features

News and Markets

o o o

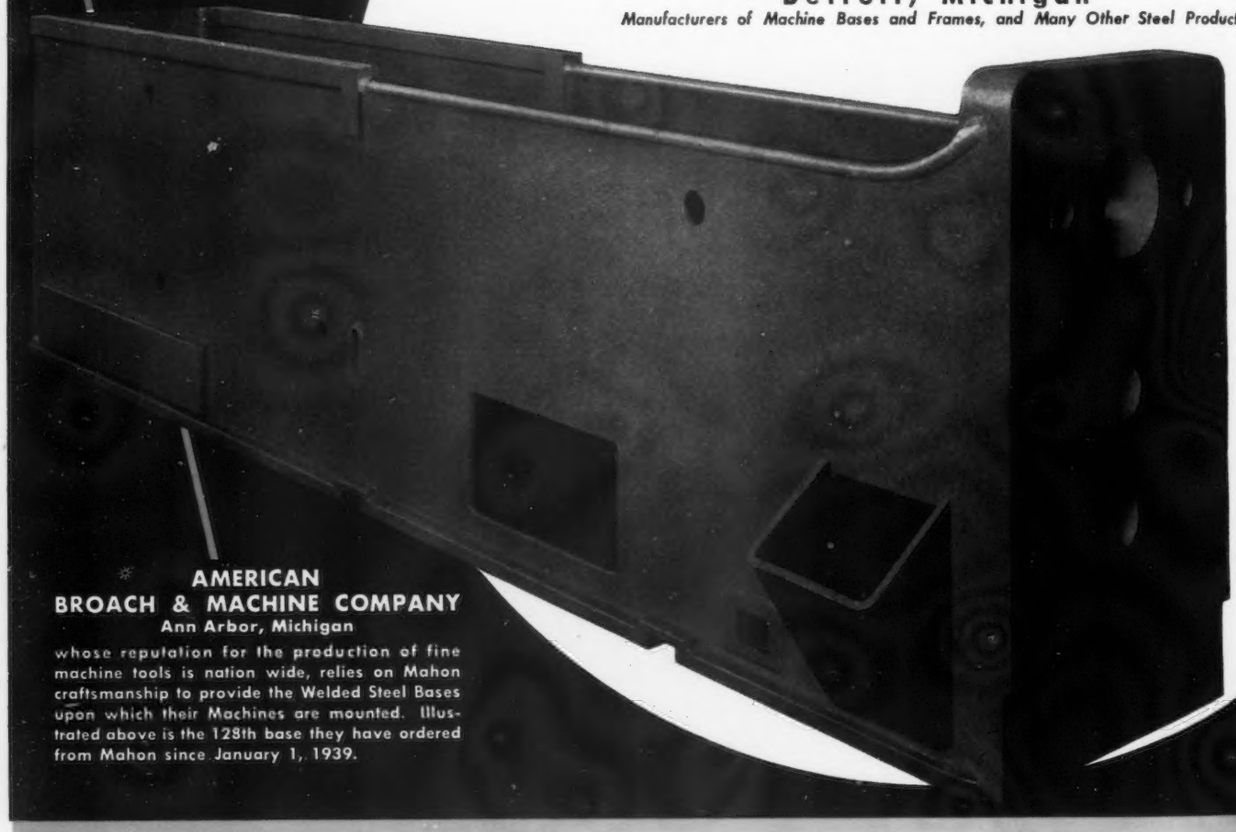
Welded STEEL Machine BASES

127 REPEAT ORDERS IN LESS THAN 3 YEARS FOR ONE COMPANY!

Satisfaction
Founded on Consistent Quality

It cannot be considered coincidence when the same manufacturer returns again and again to the same source of supply for his machine base requirements. Certainly, not to the extent of 127 repeat orders. That means consistent satisfaction founded on the consistent quality of Welded Steel Machine Bases, as fabricated by Mahon. If you, likewise, demand machine bases of exceptionally fine finished appearance and accuracy—bases upon which you will be proud to place YOUR product—send your blueprints to Mahon for quotations.

THE R. C. MAHON COMPANY
Detroit, Michigan
Manufacturers of Machine Bases and Frames, and Many Other Steel Products



AMERICAN BROACH & MACHINE COMPANY
Ann Arbor, Michigan

whose reputation for the production of fine machine tools is nation wide, relies on Mahon craftsmanship to provide the Welded Steel Bases upon which their Machines are mounted. Illustrated above is the 128th base they have ordered from Mahon since January 1, 1939.

MAHON

THE IRON AGE

DECEMBER 11, 1941

ESTABLISHED 1855

How to Cut Expenses

THE best way to cut expenses is to cut out unnecessary non-productive overhead. Every business man who has made and saved a dollar or more knows that.

Take consulting services, for example. Most businesses employ them from time to time or perhaps continuously. They are part of the overhead. But in most cases they are productive, not non-productive. In other words, the company that employs such services gets back in profits or other gains, more than the services cost. That is why these companies keep on paying for them.

Under our system of private enterprise, merchandisers of such services have to keep them sold by delivering the goods. There is thus an automatic and continuous incentive offered to the maintenance of their quality, and an equally automatic penalty imposed upon the vendors when the quality falls below an acceptable standard.

Suppose, for example, that you were a member of a group of manufacturers and business men who collectively paid a certain organization some $30 million a year for advice and information on business and industrial situations. And that as part of this service, you received information as to the use of substitutes for materials customarily used in making your product along the following lines:

You are advised, for example, to substitute chromium plated parts in electric appliances for those customarily made of aluminum. (Chromium, of course, being in such plentiful supply!)

If you have difficulty in securing aluminum grindstones, you might consider the substitution of black enamel.

If running short of aluminum linoleum edging, just change to stainless steel.

If you are a hardware manufacturer and are running out of brass doorknobs, switch to plastics. (And try and get them.)

If you can't get enough aluminum, switch to magnesium!

If a manufacturer of stainless cutlery and running out of material, change over to chrome steel!

If short of tungsten for automobile parts, change to plastics.

If you are a plywood cabinet manufacturer and are getting pinched, simply adopt ½ in. plywood instead of 1½ in.

And so on ad nauseum.

How long would you continue, as a free agent, to put up your share of the $30 million for such advisory service?

But unfortunately you can't quit, because this information is supplied you as a part of the service of the U. S. Department of Commerce.*

But if government wants to reduce its non-productive overhead, this might be a place to begin.

* Industrial Reference Service, Business Series No. 22, November, 1941.

J. H. Van Deventer

Medium tanks produced by the Pullman-Standard Car Manufacturing Co. Like others in their industry, they are helping the defense program by building tanks and other equipment for the armed forces, as well as freight cars.

Building freight cars at the General American Transportation Corp.

Inland Helps Railroads Meet Defense Emergency

Almost a million car loadings each week! That is the freight traffic now handled by the railroads, and the burden grows heavier and heavier as the defense program gathers momentum. But the railroads are meeting the challenge—by wise and efficient management—and by speeding the repair of existing rolling stock and the construction of new equipment.

And here again Inland is doing its full part in another vital phase of our country's defense program. To the freight car builders of America—to the railroad car shops—to the producers of axles, springs and other specialties—with regularity and dispatch—Inland is shipping thousands of tons of steel to help our great railroad system prepare for the gigantic task which lies ahead.

Not only for freight cars—not only for transport such as ships, trucks, pipe lines—but for countless other defense needs—Inland men and Inland mills are working day and night at top speed. For today National Defense is Inland's No. 1 Job!

All Industry Can Aid America By Helping the Railroads

Many companies have aided the defense program by helping the railroads. Others can do likewise. Here is how:

1. **Order only the kind and the number of freight cars actually needed.**
2. **Load them as rapidly as possible and to maximum capacity.**
3. **Unload incoming cars quickly.**
4. **Release all cars during the first day of free time.**

By careful planning, the Inland Steel Company has increased the average weight of outgoing carload shipments 11%—about 8% fewer cars are now required.

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Reducing Iron Ore With Hydrogen

By M. H. KALINA
Instructor in Metallurgy
and T. L. JOSEPH
Professor of Metallurgy, University of Minnesota

. . . In the treatment of very high grade ore or iron compounds for use in powder metallurgy, complete reduction is necessary. The data reported herein determines the manner in which reduction of lumps of ore progresses from the outside toward the interior.

THE major problem in the reduction of iron ore in the blast furnace is to complete deoxidation below a temperature of about 1832 deg. F. and thus minimize the gasification of carbon above the tuyeres. Under proper conditions of time, temperature, and reducing gases, particles of ore can be completely reduced to metallic iron according to a slightly exothermic reaction as follows:

(1) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2 - 22{,}680$ B.t.u.

If this reaction is not completed below 1832 deg. F. a portion of the CO_2 formed reacts with the coke according to the reaction:

(2) $CO_2 + C \rightarrow 2CO + 70{,}080$ B.t.u.

This reaction is detrimental because carbon needed at the tuyeres to sustain the temperature level required for desulphurization and the reduction of silica is gasified above the tuyeres by an endothermic reaction.

One of the most difficult problems in the operation of blast furnaces is to produce pig iron of uniform analysis from cast to cast. The specifications for manganese and phosphorus are controlled largely by the proper selection of ores, but the control of silicon and sulphur requires a close regulation of the temperature in the crucible of the furnace. Although a variation of 0.5 per cent silicon is usually permitted in basic iron, in good practice the average variation from cast to cast is about 0.15 per cent of silicon. Temperature measurements* taken on 452 casts of basic iron with a noble metal thermocouple showed an average increase of 0.05 per cent silicon for each increase of 20 deg. F. in the temperature of the iron. This indicates that when the acids in the slag range from 50 to 52 per cent, fluctuations in the temperature of the iron cannot greatly exceed 60 deg. F. if the average variation in silicon is to be held within 0.15 per cent. This relation between temperature of the iron and its silicon content for one furnace cannot be applied rigorously to other furnaces operating under widely different conditions, but, there can be no doubt about the necessity for closely controlling the temperature of the iron if a close control over silicon is to be realized. This also applies to the control of sulphur in the iron.

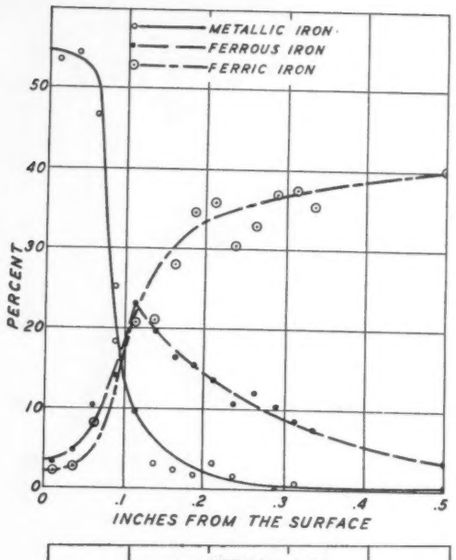
"Oxides in Basic Pig Iron and in Open Hearth Steel," by T. L. Joseph, Trans. A.I.M.E. 125, p. 204-243. (1937).

About 80 lb. of carbon are taken into solution in a net ton of pig iron. An additional 35 to 45 lb. is required in the reduction of SiO_2, MnO, and P_2O_5. These oxides are not reduced below 1832 deg. F. so that, regardless of whether reduction is direct or indirect, carbon is gasified above the tuyeres. Approximately 120 lb. of carbon is consumed above the tuyeres and cannot be brought to the combustion zones to liberate heat.

$2C + O_2 + 3.76N_2 \rightarrow 2CO + 3.76N_2 - 104{,}880$ B.t.u.

There is no way to modify substantially the carbon gasified in the reduction of MnO, SiO_2, or P_2O_5, once the analysis is specified. Moreover, a rather definite amount of carbon is taken into solution in the iron. There is, however, an opportunity to bring a larger proportion of the carbon charged to the tuyere level by a more thorough reduction of the ore below 1832 deg. F. More thorough reduction in the upper part of the furnace depends largely upon proper distribution of the gases. When using fine ore the problem is to get the gas to the surface of the particle. However, in smelting hard dense ore, the progressive reduction of large particles becomes a limiting factor in the completion of the reduction process. Such ores should be crushed and sized to obtain the best results.

In the treatment of very high



LEFT

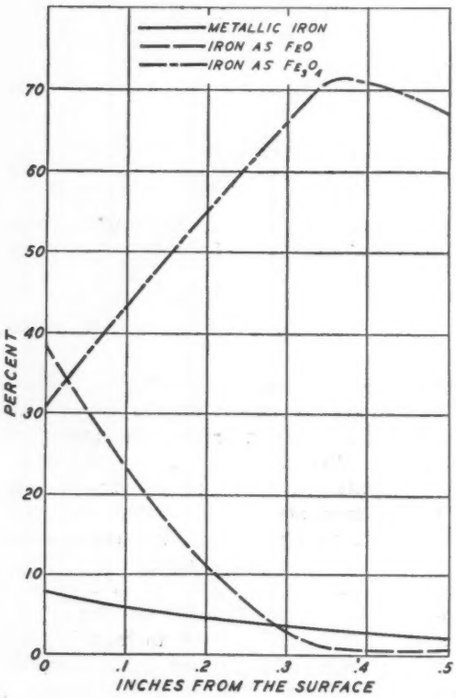
FIG. 1—Degree of reduction in various layers of a dense hematite.

° ° °

RIGHT

FIG. 2—Variations in metallic iron and calculated percentages of iron as ferrous oxide and magnetite. (Hematite 37 per cent porosity, reduced for 40 min.)

° ° °



LEFT

FIG. 3—Variations in metallic iron and calculated percentages of iron as ferrous oxide and magnetite. (Limonite 60 per cent porosity, reduced for 25 min.)

° ° °

RIGHT

FIG. 4—Variations in metallic iron and calculated percentages of iron as ferrous oxide, magnetite, and hematite. (Oölitic hematite 7.4 per cent porosity, reduced for 40 min.)

° ° °

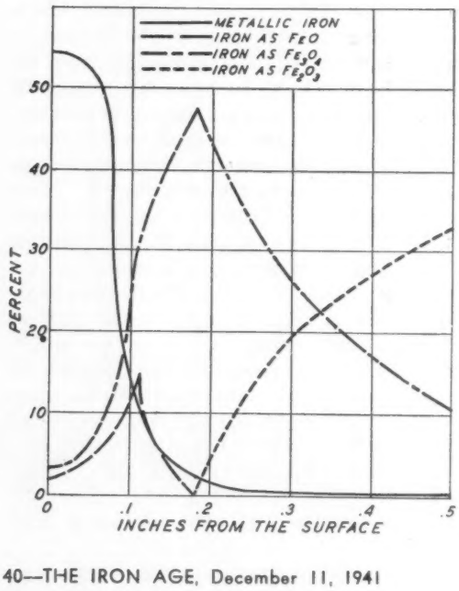


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FIG. 5—Variations in metallic iron and calculated percentages of iron as ferrous oxide, magnetite, and hematite. (Oölitic hematite 7.4 per cent porosity, reduced for 160 min.)

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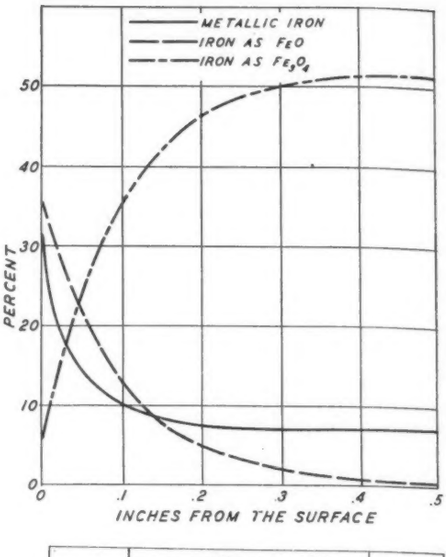
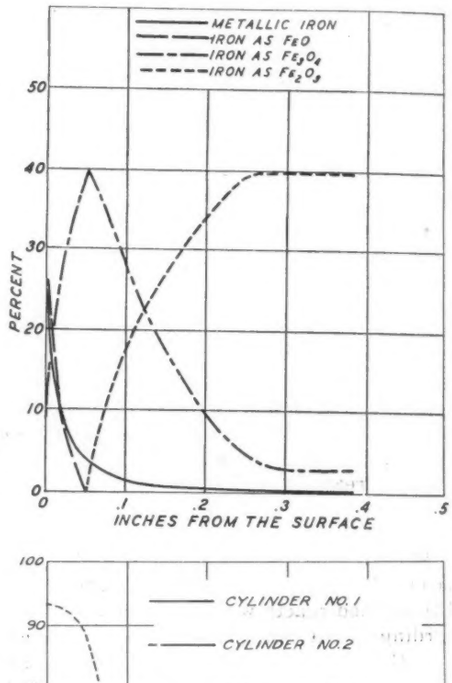
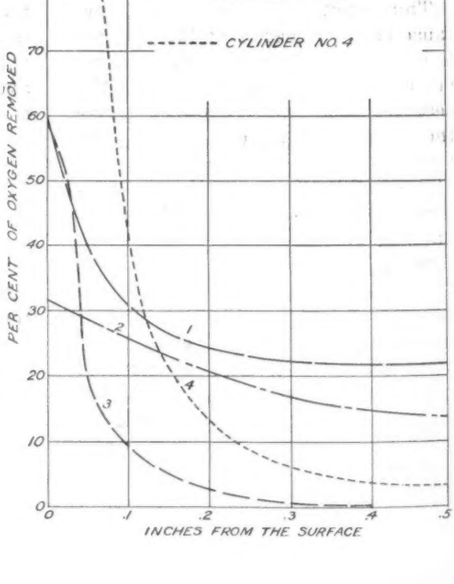
FIG. 6—Per cent of oxygen removed at various distances from the surface of test cylinders.







grade ore or iron compounds for use in powder metallurgy, complete reduction is necessary. Although the chemical analysis of the ore is important, ease of reduction is also a factor, particularly if the operation is to be conducted on a large scale.

The usual procedure in dealing with the reduction of iron ore is to follow its course by analyzing the gas phase. Such studies* have shown that porous ores reduce more rapidly than dense ores. Very little work has been done, however, to determine the manner in which reduction of lumps of iron ore progresses from the outside toward the interior. The present work was undertaken to observe the changes in the solid phase with the idea that such observations would give a better insight into the reduction process and the reasons for wide differences in the reducibility of various ores.

"Porosity, Reducibility and Size Preparation of Iron Ores," by T. L. Joseph, Trans. A.I.M.E. 120, p. 72-89. (1936).

The experiments were carried out on three varieties of ores with porosities ranging from 7.4 to 60 per cent. The time of reduction was varied, depending upon the porosity, to give partially reduced materials. The degree of reduction throughout the specimen was found by chemical analysis of samples taken at different depths from the surface.

Apparatus and Experimental Method

Several reducing agents such as carbon, carbon monoxide, or hydrogen, can be used to reduce iron ore. Hydrogen was chosen to avoid carburizing the iron and to simplify the analysis. The rate of flow of the dried gas was fixed at 600 c.c. per min. and the temperature maintained at 1300 deg. F. Nitrogen was used to establish a neutral atmosphere during the cooling period.

A limonite of 60 per cent porosity, a hematite of 37 per cent porosity and an oölitic hematite of 7.4 per cent porosity were used. The reduction time was varied from 25 min. on the most porous material to 160 min. on a dense oölitic ore from Alabama. The porosity was determined by a procedure described previously by one of the writers.*

"Porosity Reducibility and Size Preparation of Iron Ores," by T. L. Joseph, Trans. A.I.M.E. 120, p. 74. (1936).

Small natural crystals of hematite and magnetite were also reduced to follow the course of reduction in a single crystal. After partial reduction, these specimens were mounted in lucite for microscopic examination and the preparation of photomicrographs.

A sphere or a large flat surface would be the ideal shape for following the progress of reduction by changes in the solid phase. It is difficult, however, to prepare spheres and to effect reduction across a large flat surface. A compromise was to use cylinders 1 in. in diameter and 2½ in. long. These were cut out on a lathe and ground to final shape. Samples were taken from a section about 1.5 in. long in the middle of the cylinder. In the middle sections of the cylinders, reduction proceeded from the sides only and errors due to "end effects" were avoided.

The apparatus used for reduction was similar to that described by Tenenbaum and Joseph.* A 30-in. length of 1½-in. black iron pipe, capped on both ends was used in place of the usual quartz tube for the reduction chamber. Gas inlets and outlets were made by threading ⅛-in. iron pipes into the caps. The furnace was maintained at a temperature of 1300 deg. F. during all the reduction tests.

"Reduction of Iron Ore Under Pressure by Hydrogen," by Michael Tenenbaum and T. L. Joseph, Trans. A.I.M.E., p. 135-66. (1939).

†*"Oxide Analysis in Iron Ore Reduction Problems," by T. L. Joseph, F. W. Scott, and M. H. Kalina, Blast Furnace and Steel Plant vol. 20 No. 10. p. 975-78; vol. 28 No. 11, p. 1073-77 (1940).*

After reduction, sampling was accomplished by removing concentric layers of the partly reduced ore from the cylindrical test specimens. When the unground central portion of the specimen became so thin that it shattered, the remaining portion was considered as a single layer. The concentric layers were removed with an emery wheel about 0.75 in. in diameter. Only a fraction of 1 per cent of emery appeared in the ground sample. This extraneous material acted merely as a diluent and did not interfere with the chemical analysis.

The samples were analyzed for free iron, ferrous iron, and ferric iron, by a method described in a previous paper.†

The percentages of free iron in samples from the central portion of the cylinders did not always decrease regularly. This is due to the difficulty of obtaining a correct analysis on very small samples.

Discussion of Results

Table I gives the percentage of free iron, ferrous iron, and ferric iron at different depths from the surface of the various ore cylinders. These values may be graphically represented as in Fig. 1, which gives the results for cylinder 4 in the form of graphs.

To obtain a better picture of the conditions in the partially reduced specimens, these values were converted to percentages of iron present as free iron, ferrous oxide, magnetite, and hematite. The amounts of magnetite and hematite were calculated as follows: The ferrous and ferric iron in the ore specimen were considered to be combined in the ratio of 1:2 respectively forming magnetite, $FeO.Fe_2O_3$, until one or the other was consumed. Ferrous iron in excess of this ratio was considered to exist as ferrous oxide and similarly any excess of ferric iron was considered to exist as hematite.

Two examples will be given to illustrate the method. Consider the surface of cylinder 4 which contains 2 per cent of ferric iron and 3 per cent of ferrous iron. If these forms of iron combine to form magnetite, all of the ferric iron and 1 per cent of the ferrous iron will be used to form 3 per cent of iron as magnetite. The remaining 2 per cent of ferrous iron is considered to exist as ferrous oxide. These values are represented graphically in Fig. 5.

Similarly, if the layer 0.2 in. deep in cylinder 4 is considered, the ferric iron is 33 per cent and the ferrous iron 14.5 per cent. If these amounts of ferrous and ferric iron combine to form magnetite, all the ferrous iron and 29 per cent of the ferric iron will be used to form 43.5 per cent of iron as magnetite. The remaining 4 per cent of ferric iron represents the percentage of iron in the form of hematite (see Fig. 5). The same method was used to calculate the percentages of iron present as ferrous iron, magnetite, and hematite, in the other partially reduced specimens. The results are shown graphically in Figs. 2, 3, and 4.

Effect of Porosity

Fig. 2 represents the state of reduction of a hematite of 37 per cent porosity reduced for 40 min. The

free iron decreases from about 30 per cent on the surface to about 7 per cent at a depth of 0.2 in. and persists at this value throughout the remaining portion of the specimen. The iron as ferrous oxide drops from 35 per cent on the surface to about 7 per cent at a depth of 0.15 in. Beyond this depth most of the iron exists as metallic iron or as magnetite since no unreduced hematite is present. The iron as magnetite increases from 7 per cent on the surface to 50 per cent at a depth of 0.3 in. with little change beyond this point.

Fig. 3 shows the degree of reduction in a very porous sample reduced for 25 min. The per cent of metallic iron decreases from 8 per cent on the surface to about 2 per cent at the center. The high porosity of this sample evidently permitted the hydrogen to diffuse readily to the very center of the specimen which contained one-quarter as much free iron as the surface. The outer 0.3 in. is reduced beyond the state of magnetite while the remaining central area is largely magnetite. The curves for ferrous oxide and magnetite are similar to those in Fig. 2. In both of these porous specimens, all the original hematite has been converted to magnetite in the central portion of the cylinder and reduced well beyond magnetite near the surface as indicated by an excess of ferrous oxide.

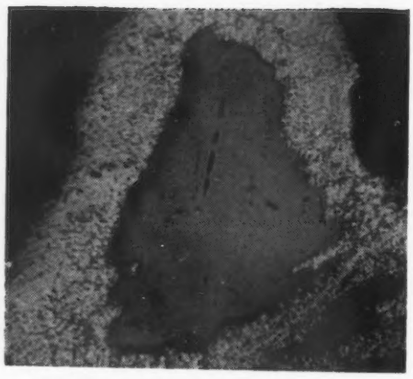


FIG. 7—Shell of metallic iron around a center of a crystal of hematite. At 100 diameters.

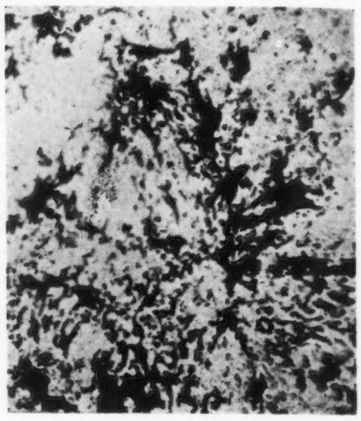


FIG. 8—Outer portion of the layer of iron. At 1000 diameters.

Figs. 4 and 5 give the results for a dense, oölitic Alabama hematite, with a porosity of 7.4 per cent. The periods of reduction for these specimens were 40 and 160 min. respectively. The free iron in Fig. 4 decreases rapidly from about 24 per cent at the surface to 10 per cent at a depth of only 0.02 in., and then more slowly to 2 per cent at a depth of 0.1 in. Beyond this point only small amounts of free iron were formed. The important fact brought out here is that although there is some reduction throughout the greater part of the specimen, the greatest reduction takes place on the surface and rapidly approaches a small limiting value farther in.

Fig. 5 gives the results for the other specimen. Approximately 54 per cent of iron on the surface, and to a depth of almost 0.07 in. was present as metallic iron. Beyond

TABLE I Percentages of Metallic, Ferrous and Ferric Iron in Cylinders of Partially Reduced Iron Ore

Cylinder No. 1, Hematite Porosity, 37 Per Cent, Reduced for 40 Min.

Average Depth From Surface, In.	Iron in Various Forms, Per Cent		
	Free	Ferrous	Ferric
0.012	23.8	37.3	6.7
0.037	13.1	31.1	19.5
0.062	12.6	28.5	20.4
0.087	10.7	26.6	22.4
0.112	6.5	24.8	28.2
0.137	7.7	24.1	27.2
0.162	7.8	22.3	28.9
0.187	8.6	20.3	30.1
0.212	6.4	20.7	31.9
0.237	6.7	19.6	32.5
0.262	7.7	18.2	33.1
0.287	9.9	18.2	29.2
0.312	7.2	19.0	32.3
0.337	6.5	17.5	34.0
0.425	7.1	17.5	33.6

Cylinder No. 2, Limonite, Porosity, 60 Per Cent, Reduced for 25 Min.

Average Depth From Surface, In.	Iron in Various Forms, Per Cent		
	Free	Ferrous	Ferric
0.012	7.5	42.0	21.4
0.037	7.2	45.2	21.0
0.062	5.5	45.1	21.4
0.087	7.0	41.6	22.4
0.112	6.4	39.2	29.0
0.137	4.8	37.6	31.0
0.162	6.1	32.7	33.2
0.187	5.9	30.0	35.2
0.212	5.3	29.2	39.1
0.237	5.4	26.7	40.5
0.262	2.9	27.7	41.0
0.287	2.4	26.1	44.7
0.312	0.8	27.0	49.0
0.337	4.0	23.5	47.1
0.362	3.8	23.5	45.5
0.437	3.2	23.3	44.5

Cylinder No. 3, Oölitic Hematite, Porosity, 7.4 Per Cent, Reduced for 40 Min.

Average Depth From Surface, In.	Iron in Various Forms, Per Cent		
	Free	Ferrous	Ferric
0.012	16.6	22.5	12.3
0.037	4.5	14.4	30.1
0.062	2.4	13.6	31.2
0.087	0.7	12.0	33.8
0.112	0.3	10.2	37.1
0.137	0.86	7.5	38.4
0.162	0.88	5.0	40.5
0.187	0.35	3.5	42.8
0.212	0.21	2.6	41.2
0.237	0.56	1.1	37.5
0.262	0.05	1.1	40.9
0.287	0.00	0.9	41.7
0.312	−0.10	0.9	41.5
0.337	−0.47	0.9	40.8
0.425	−0.40	1.0	43.0

Cylinder No. 4, Hematite, Porosity, 7.4 Per Cent, Reduced for 160 Min.

Average Depth From Surface, In.	Iron in Various Forms, Per Cent		
	Free	Ferrous	Ferric
0.012	53.5	3.3	2.1
0.037	54.4	4.6	2.6
0.062	46.3	10.1	8.2
0.087	25.5	18.3	13.8
0.112	9.8	22.8	20.5
0.137	2.4	19.9	20.8
0.162	2.0	16.3	27.9
0.187	1.3	15.3	34.2
0.212	2.6	13.4	35.8
0.237	1.2	10.6	30.0
0.262	−0.1	12.0	32.5
0.287	0.0	10.1	36.8
0.312	0.4	8.5	37.5
0.337	0.5	7.1	35.0
0.425	0.4	3.4	40.4

this point the amount of metallic iron drops very rapidly to about 5 per cent at a depth of only 0.15 in. From this depth to the center, the shape of the free iron curve is similar to that of the previous figure except that it has shifted to the right. Although some reduction to free iron has occurred throughout the specimen, this curve shows that in a dense ore most of the final reduction to metal takes place in a narrow reaction zone, about 0.02 in. wide. This zone progresses slowly with time.

In Fig. 4 the ferrous iron, in excess of magnetite, decreases from 25 per cent on the surface to zero

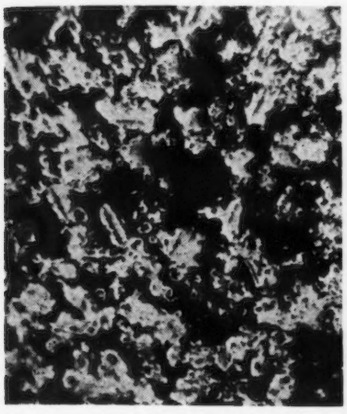


FIG. 9—Middle portion of the layer of metallic iron. At 1000 diameters.

at a depth of only 0.05 in. In other words, reduction has proceeded beyond the stage of magnetite in a very narrow zone near the surface. Beyond this narrow zone hematite appears and rapidly rises to a constant value of 40 per cent at a depth of 0.25 in. The iron as magnetite increases rapidly from about 10 per cent on the surface to a maximum of 40 per cent at a depth of 0.05 in. and then decreases as more and more hematite appears. The curves in Fig. 5 have the same general shape as those in Fig. 4 except that the positions of maximum ferrous iron and magnetite and the point at which hematite appears are shifted to the right. It is interesting to note that although this specimen was reduced for 160 min., hematite appears at less than 0.2 in. from the surface and increases to substantial amounts beyond this point.

Fig. 6 shows the per cent of oxygen removed at various distances from the surface of the test cylinders. These curves are roughly parallel to the free iron curves in Figs. 2, 3, 4 and 5. They indicate that as the porosity of iron ore decreases, reduction tends to take place in a single narrow reaction zone which progresses inwardly. As the porosity increases, this zone progressively widens, until, as in the specimen of 60 per cent porosity, a considerable amount of oxygen is removed throughout the sample. With this high porosity, about one-half as much oxygen was removed from the center of the specimen as from the surface. This applies in a lesser degree to cylinder No. 1 with a porosity of 37 per cent.

Microstructure of Crystals

Fig. 7 is a photomicrograph, at 100 diameters, of a partially reduced crystal of hematite. The white area surrounding the dark unreduced center appears to be thoroughly reduced at this magnification. However, Fig. 8 taken near the surface at 1000 diameters, shows unreduced oxides. In Fig. 9, taken at the middle of the white area, a larger amount of oxides is

FIG. 10—End of zone containing metallic iron. At 1000 diameters.

evident. The final reduction to metallic iron evidently takes place in localized areas, which seem to have a definite boundary, as shown by Fig. 10. The transition between the dark and the light portions of Fig. 7 are shown at 1000 diameters in this figure.

Fig. 11 is a photomicrograph of a partially reduced crystal of magnetite at 100 diameters. The reduction has taken place in planes running at angles of about 60 and 120 deg. These are probably crystal planes which for some reason permitted the hydrogen to penetrate more readily. Such a structure is rare, but it serves to emphasize that even in relatively small crystals, reduction tends to follow definite paths and to occur in isolated areas. If the crystals were the same size as the unreduced areas in Fig. 11, reduction to metallic iron would advance in a very narrow zone of reaction.

Summary

In the reduction of particles of iron ore smaller than 0.001 in. in diameter, it can be expected that the reaction zone will be very narrow because such particles would be fragments of crystals relatively free from discontinuities.

In larger crystals of ore, many small included particles, and discontinuities afford paths of ready penetration for the reducing gas. This permits reduction to take place in a number of localized areas within the crystal. (See Fig. 11.)

In the case of lumps of ore, the picture changes from one of a single imperfect crystal to a larger aggregate of very small crystals, interspersed with gangue. Such material would also contain connected pores and minute cracks. The reduction in this case starts on the outer grains, but the discontinuities permit the reducing gas to diffuse into the particle thus widening the zone of reduction.

In the ore with a porosity of 60 per cent, reduction took place throughout the specimen. On the basis of the percentage of oxygen removed, the rate of reduction in the center was one-half as fast as on the surface. In the sample with a porosity of 37 per cent, the center was less thoroughly reduced. In the case of a dense Alabama ore, the reaction was largely confined to a very narrow zone 0.04 in. wide.

FIG. 11—Partially reduced crystal of New Jersey magnetite. At 100 diameters.

Specification Plating

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. . . Answers to many problems arising in specification plating and tables showing plating times for various deposits are included in this series of two articles. Also, methods of determining deposit thickness are explained.

ORDINARILY, specification plating is important because of its use in the plating field. It has been the policy of several large automobile concerns and the National Government to have all coatings meet definite standards. Many who have been looking into the future of electroplating have made predictions that specification plating would become more and more important, and this has been true to a large extent. However, due to the present emergency, the problem of specification plating has become almost universal because much of the industrial output is being used to manufacture materials directly or indirectly for the Army and Navy.

Often when plants are called upon to do specification jobs, it is found that the organizations are not set up to produce. When such conditions arise the plater or foreman makes an attempt to overcome the problems at hand, or the engineering department is called upon to struggle with the situation. This article will attempt to answer many questions arising in specification plating, and tables are shown that give the time required to produce definite thicknesses of metals.

In order to obtain definite thicknesses of metal, four points must be observed, namely: (1) The amount of metal that must be deposited; (2) the theoretical time necessary to obtain this deposit at any given current density; (3) the actual time necessary to complete the deposit, and (4) methods of checking the thickness of these deposits to see if the desired amount of plate has been obtained. Each of these will be taken up in its order.

For a long time the question of how much metal should be deposited on a given surface has been a problem to many organizations interested in this metallurgical field. In the past few years the American Electroplating Society, the American Society for Testing Materials, and the Government Bureau of Standards have conducted extensive research in order to determine practically the thickness of various metallic deposits for different requirements. Five different test sites throughout the United States were chosen because of their differences in atmospheric conditions. At each of these points, plates were exposed and their conditions observed over a period of several years. This experimental work has been completed for nickel, chromium, copper, zinc, and cadmium on steel. The data for other metals and alloys will be released as soon as the research is complete.

The results of the tentative specifications are as follows:

Zinc on steel:			
General service	0.0005 in.		
Mild service	0.00015 in.		
Cadmium on steel:			
General service	0.0005 in.		
Mild service	0.00015 in.		
Chromium, nickel and copper on steel:			
	Copper and Nickel	Final Nickel	Chromium
General service	0.00075 in.	0.0004 in.	0.00002 in.
Mild service	0.0004 in.	0.0002 in.	0.00002 in.

While the exact standards set up may not be adapted by the government or private concerns, they will at least serve as a guide in setting up specifications.

As a general rule, plants doing plating today do not have to worry about specifications, because the government generally attends to that. Therefore the first part of the problem is generally solved through the adaptations of definite amounts of metal to be deposited, by the government. The theoretical amount of the metal to be deposited is dependent upon three factors: (1) the amount of current, (2) the time for which it flows, and (3) the electrochemical equivalent of the metal or alloy being deposited. These were discovered by Michael Faraday. He observed, for example, if one amp. was passed through a copper sulfate solution for one hr., a definite deposit of copper was obtained. If two amp. were passed through this solution for one hr., twice as much copper was deposited. It was also observed by Faraday that if copper was used as an anode the same amount of copper was lost by this electrode as was gained by the cathode.

By noting many similar experiments, Faraday was able to express these as a theory which later became the first law of Faraday, stated as follows: *The quantity of metal dissolved at the anode or deposited at the cathode is dependent upon the time a given current flows.* It will be noted that this law considers only one metal at a time;

FORTIETH in a Series of Articles on the Technical and Economic Aspects of Metal Cleaning and Finishing

the relationship between different metals not being considered. Faraday recognized this and made other experiments to obtain such relationships. He found that a definite current flowing for a given time would deposit the metal in chemical equivalent quantities, and this is known as the second law of Faraday, stated as follows: *The amounts of different metals dissolved at the anode or deposited at the cathode by the same quantity of electricity are proportional to their equivalent weights.*

From the first law it is readily seen that a definite amount of constant current is needed to deposit an equivalent weight of a metal Silver, for instance, requires one amp. to deposit 1,1180 milligrams in one sec. Silver has a valence of one, therefore, the atomic weight is equal to the equivalent weight, which is 107.88. If this figure is divided by 0.001118, 96,483.7 coulombs is obtained. This is roughly 96,500 coulombs of electricity and it will deposit one equivalent weight of silver. Due to the relationship existing between other elements, this is also true for any other metal. This amount of current is known as a Faraday and is also equal to 26.805 amp.-hr. The electrochemical equivalents for many important industrial metals is given in Table I.

Both of Faraday's laws may be expressed as:

$$W = CTZ$$

where: W *is the weight of metal dissolved at the anode or, the weight of the metal deposited at the cathode;* C *is the current flow;* T *is the time of the operation; and* Z *is the electrochemical equivalent.*

It should be emphasized that Faraday's laws assume that all the current flowing through a given bath is used to dissolve the metal from the anodes or to deposit it at the cathode. This is very seldom true in practice, because many times the current has a tendency to produce a second reaction. For instance, in a copper bath using a soluble anode, not all of the current is used to dissolve the copper, some being used in liberating oxygen; while at the cathode some of the current is used to produce hydrogen instead of depositing copper. The same is true for any impurity in solution that is oxidized at the anode or reduced at the cathode.

With this in mind it may be observed that the practical time for obtaining a given deposit is generally longer than the theoretical time, and the electroplater must take this into consideration when plating to specification. The size of this loss or the increase in time required depends upon several factors and may be summed up by the phrase, "current efficiency." For example, if all the current is used to dissolve nickel at the anode and deposit it at the cathode, the current efficiency would be 100 per cent. This means that all the metal calculated by Faraday's law would be deposited. Thus, current efficiency is nothing more than a comparison of the metal dissolved at the anode or deposited at the cathode with the theoretical amount calculated according to Faraday's law, and may be stated as follows:

Per cent anode efficiency = amount of metal actually dissolved x 100. Amount of metal dissolved according to Faraday's laws.

Per cent cathode efficiency = amount of metal actually deposited x 100. Amount of metal deposited according to Faraday's laws.

These equations may be used to calculate the efficiency of either electrode, and these factors must

TABLE I

RESULTS OF ANODE AND CATHODE EFFICIENCY TEST

Anode Efficiency, Per Cent	Cathode Efficiency, Per Cent	Change in Concentration of Metallic Ion Being Plated	pH	H_2 Evolved, Per Cent	O_2 Evolved, Per Cent
100	100	No change	Decreases	None	None
80	80	No change	Increases	20	20
90	80	Increases	No change	10	20
80	90	Decreases	No change	20	10

TABLE II

ELECTROCHEMICAL EQUIVALENTS FOR THE MOST IMPORTANT METALS

Element	Symbol	Atomic Weight	Val. or Cg. Val.	Mg. per Coulomb	Coulomb per Mg.	Grams per Amp. Hr.	Amp. Hr. per Gram	Lb. per 1000 Amp. Hr.	Amp. Hr. per Lb.
Cadmium	Cd	112.41	2	0.58244	0.71693	2.09677	0.47692	4.62258	216.329
Chromium	Cr	52.01	6	0.08983	10.13247	0.32338	3.09235	0.71293	1402.668
			3	0.17965	5.56624	0.64676	1.54618	1.42585	701.334
Cobalt	Co	58.84	2	0.30539	3.27452	0.90966	1.00966	2.42356	412.617
Copper	Cu	63.57	2	0.32983	3.03602	1.18576	0.84334	2.61416	382.532
			1	0.65876	1.51801	2.37152	0.42167	5.22831	191.266
Gold	Au	197.2	3	0.68117	1.46805	2.45223	0.40779	5.40627	184.792
			1	2.04352	0.48935	7.35668	0.13593	16.21871	61.657
Hydrogen	H	1.0078	1	0.010444	95.75313	0.037597	26.59809	0.082886	12064.693
Iron	Fe	55.84	2	0.28933	3.45630	1.04158	0.96008	2.29628	435.487
Lead	Pb	207.21	2	1.07363	0.93142	3.86506	0.25873	8.52099	117.357
Nickel	Ni	58.69	2	0.30409	3.28846	1.09474	0.91346	2.41348	414.340
Oxygen	O	16.0000	2	0.082902	12.06250	0.29845	3.35069	0.65796	1519.850
Platinum	Pt	195.23	2	1.01155	0.98858	3.64160	0.27460	8.02834	124.559
Phodium	Rh	102.91	3	0.35547	2.81314	1.27971	0.78143	2.82128	354.449
Silver	Ag	107.880	1	1.11793	0.89451	4.02454	0.24848	8.87259	112.707
Tin	Sn	118.70	2	0.61503	1.62595	2.21409	0.45165	4.88124	204.866
Zinc	Zn	65.38	2	0.33876	2.95197	1.21952	0.81999	2.68859	371.942

be taken into consideration when calculating the time required to deposit a given amount of metal in a bath. From the point of specification plating, considered by itself, the plater is not interested in what takes place at the anode, as this factor enters into the discussion only indirectly. Therefore, the cathode efficiency is the important item. Thus, it can be seen that Faraday's laws can be used to calculate the amount of metal plated under given conditions or the theoretical time required to give a definite weight or thickness of metal.

Current density may be defined as the current per unit area, or amp. per sq. ft. or amp. per sq. decimeter. This is nothing more than the concentration of current over a given surface. The factor is important since it definitely affects the electrochemical reactions taking place at the electrodes. An example of this is present in the anode reaction of the basic tin bath. Below 70 amp. per sq. ft., tin dissolves at the divalent ion, while above this amperage the metal goes into solution as the quadrivalent ion.

The factor of current density is

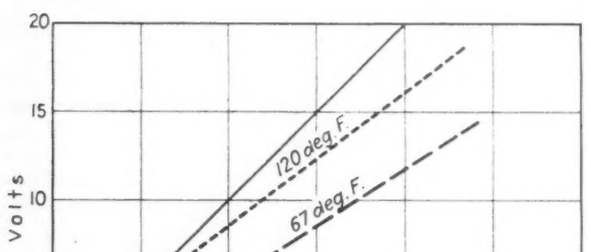


FIG. 1—A cuprous cyanide solution was introduced into a Haring cell and current passed through the bath between a copper anode and cathode. The data obtained for different current densities and temperatures are graphically shown here.

It was shown that anode and cathode efficiencies equal 100 per cent only when all the current passing through the bath was utilized in dissolving at the anode or depositing at the cathode the specific metal under consideration. If any current is used to accomplish any other electrochemical reaction, the efficiency of that electrode immediately drops. If the cathode efficiency is 50 per cent, only half of the current being supplied to the bath is used to deposit the metal in question. Therefore, the actual time required to produce the given amount of metal will be twice as long as that required to deposit a given amount of metal at 100 per cent electrode efficiency.

Under the heading of the actual time necessary to deposit a given amount of metal two other points should be considered. These are: (1) The best methods used in determining the correct current density, and (2) the significance of plating at a given voltage instead of a given current density. In discussing methods to determine the correct current density, it will be observed that this is an important factor in the accompanying tables.

rather easy to discuss, but, in many instances, hard to determine practically. If the work being plated is uniform, the area can be calculated once and for all. However, if the material varies, as in many shops, this factor must be determined many times, and this is not only time consuming but monotonous. However, in several plants the area of each piece is calculated by the engineering department and noted on the original tracing. The plater checks on this area from the prints and adds up the total for a tank load.

Pilot Cathode

In order to overcome these difficulties the writer and one of his co-workers, S. C. Taormina, devised a method that eliminated the determination of areas. It may be described as follows:

Placed into the bath containing the work to be plated is a pilot cathode having a definite area. An ammeter and suitable resistance is connected in series with this electrode so that the current flowing could be determined. Thus, the current flowing through the pilot of known area can be readily determined and in this way the current density can be calculated. If the current density of the work is the same as that of the pilot, the problem is automatically solved.

Many runs were made in which a number of hollow-ware articles, such as loving cups, water pitchers, gravy bowls, trays, goblets, etc., were plated. The pilot was racked in with the work and plated during the run. It was shown conclusively that such a system is practical if used with the following precautions: (1) Work must be distributed in the tank as evenly as possible; (2) the load being plated in any one tank must be similar in shape and size; (3) all electrical connections must be clean, and, (4) in order for the pilot to give the correct current density it must be properly spaced in reference to the anode and cathode areas.

Before the pilot cathode method can be adapted to any production scheme it is essential that several loads of work be plated and the amount of metal deposited determined. The variables should be adjusted so that the pilot cathode will give the correct reading.

As stated, the relationship of voltage to current must be considered. In Faraday's laws it will be recalled that the voltage is not mentioned. The amount of metal deposited is proportional to the current flowing, the time it flows, and the electrochemical equivalent of the metal. The only possible way that the voltage enters this discussion is by way of Ohm's law, which states that: *The voltage of a system is dependent upon the current flowing and the resistance offered to its flow.* Thus, for a given current flow the voltage will depend upon the resistance of the system, and the voltage will vary when the following change: (1) The distance between anode and cathode; (2) the composition of the bath; (3) polarization of the electrodes, and, (4) the temperature of the bath.

If it is assumed that 1, 2, and 4, are constant and only 3, electrode polarization, is changed, there still is not straight line function between voltage and current because of the complex nature of this factor. In order to show the complex relationship, a cuprous cyanide solution was introduced into a Haring cell and a current was allowed to flow through the bath, using a copper anode and cathode. The current was allowed to flow for a comparatively short time and the volt-

age was measured. These data were obtained for different current densities and temperatures, and the results are shown in the graph opposite.

When the distance between the anode and cathode was changed, an entirely different relationship resulted. Also if the concentration of the solution was altered, different data were obtained. The solution contained:

Cuprous cyanide	3 oz. per gal.
Sodium cyanide	4.4 oz. per gal.
Sodium carbonate	5.0 oz. per gal.

In order to know the amount of metal deposited with any given voltage, the relationship between the current and voltage must be determined under conditions similar to that of the work being plated. Generally, it will be easier to determine the current density directly.

The manner in which the weight of the metal deposited can be determined is another important point. For cathode efficiencies, a pilot cathode of any desired shape or size can be used instead of the ordinary work. Thus, a piece may be chosen that can be conveniently weighed, as has already been discussed. Another method of determining the amount of metal deposited is to obtain the thickness of the plate and from this calculate the volume and weight of metal contained. The thickness of the coating can be determined in a number of ways, which will be discussed later.

There are very few cases in which cathode efficiencies even approach 100 per cent. In the case of copper sulfate baths, efficiency is generally 90 to 95 per cent, and for nickel baths, it is also high. However, cyanide baths usually have low cathode efficiency, ranging from 50 to 80 per cent in most cases. Chromium baths give a very low figure, being around 10 to 15 per cent. The anode efficiencies are of indirect importance to the electroplater, as will be shown.

When the anode efficiency is greater than the cathode efficiency, a change will occur in the bath. If this condition is analyzed it will be seen that more metal is going into the bath from the anode than is being removed by the cathode. Under these conditions, the metallic ion will build up in the bath, or the bath will become more concentrated in terms of the metal being deposited, and the metal ion will take the place of hydrogen ion in solution, which is another way of saying that the pH of the solution will increase, or the bath acidity decreases. It must be remembered that an increase in pH indicates a decrease of hydrogen ions. Conversely, if the anode efficiency is less than the cathode efficiency, the solution will become depleted in regard to the metallic ion being plated and the pH will decrease or the solution will become more acid. These are important facts because they have a direct bearing upon the current efficiencies. Also, if such a bath is not checked periodically it will finally reach the point where an acceptable plate can not be produced.

With this in mind, it can be said that current efficiencies of 100 per cent are seldom obtained. However, the current efficiency should be as high as possible and the anode efficiency should equal, if possible, the cathode efficiency so that a balanced solution may be sustained as summarized in Table II. From Table II it will be seen that for the best results the anode efficiency should equal the cathode efficiency and both should be as near 100 per cent as possible. For the sake of clarity it is assumed that all the current not dissolving or depositing the metal in question is utilized in either liberating oxygen at the anode or hydrogen at the cathode.

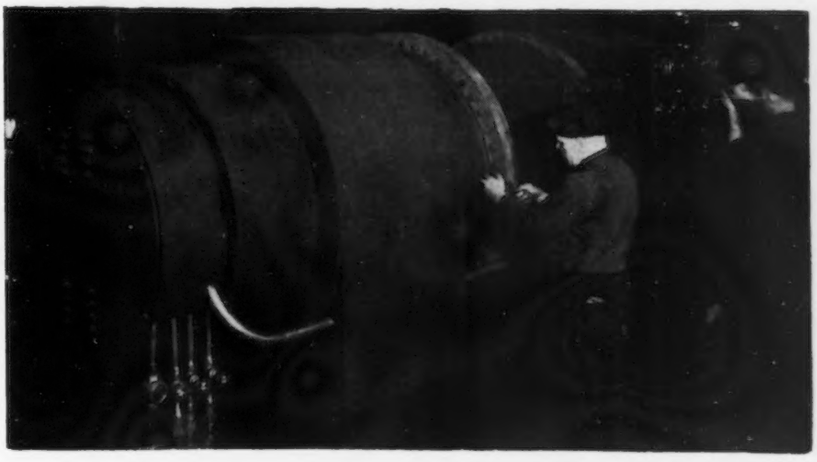
Editor's Note: Nine methods of checking deposit thickness, as well as tables for various metals for estimating the time necessary to produce given deposits at various known current densities, will be shown in the second and last part of this article next week.

Hydrogen Cooling Used for Induction Heating Generator

HIGH frequency motor-generator sets for induction heating are now becoming so large as to warrant the use of hydrogen cooling. The illustration shows one such unit recently supplied by Westinghouse for the Budd Induction Heating Co. in Detroit. A similar unit has also been installed at the Caterpillar Tractor Co. plant in Peoria, Ill. Both these 9600-cycle units consist of a 500-kw. generator driven by an 800-hp., 3600-r.p.m. squirrel cage induction motor.

After the machines are set up, carbon dioxide gas is used to scavenge the air in the sealed housings, and then hydrogen gas is introduced from a bottle at the rear. The hydrogen is circulated by a blower and is cooled by water in a cooler mounted at the left end of the generator in the picture; water is also circulated through the stator frames. The control instruments in view are four bearing temperature indicators, gas temperature indicators, oil pressure gage, gas pressure gage and a U-type gage connected across the motor blower.

On the four main bearings, shoe type bearings operating on the pivoted pad principle are used. For the small poles and air gap of a high frequency machine, the machining and alinement must be accurate to reduce unbalanced magnetic pull, which under these conditions is sufficient to overcome the weight of the rotor. These bearings are designed to carry a load in any radial direction and will support a much higher load than conventional bearings.



Surface Structures and Chemistry of Heat T

IN the first section of this three-part article, presented last week, attention was directed to treating in a smith forge, preheating, metal oxide zone, etc. Next to be considered is the effect of superheating vs. atmosphere on surface carbon.

Under "Preheating" it was found that this type of steel does not show any change in surface carbon under the usual preheating conditions. During the commercial superheating of this steel, gas-fired, oil-fired and atmosphere-controlled furnaces are employed. The most generally used temperature range is 2300 to 2375 deg F. Data were secured when using a gas-fired furnace operated at a temperature of 2350 to 2360 deg. F. The fuel employed was by-product coke oven gas of the following analysis:

Carbon dioxide	1.8
Illuminants	3.3
Oxygen	0.3
Carbon monoxide	8.5
Methane	24.7
Hydrogen	51.0

The type furnace employed was a two-high furnace, i.e., one in which the preheating compartment is located directly above the superheating chamber, and the exhaust gases from the superheating chamber serve to heat the preheat compartment; consequently, the atmospheres in both the preheat and the superheat are identical. The range of atmospheres in this furnace was rather limited since they were controlled with a gas-air mixer which had a narrow operating range. Four atmospheres were studied, namely 2.5, 3.0, 6.3 and 7.8 per cent carbon monoxide. The temperature of the preheater was 1600 deg. F. The samples were in the preheat compartment for a total time of 8 min.. and in the high heat for a total time of 5 min., approximately 3 min. to come to heat, 2 min. at heat. Sections were oil quenched and after semi-annealing, turnings were obtained for chemical analysis. These results are shown in Table III. It will be seen that all four atmospheres produced slight carburization.

The second furnace employed was oil-fired. The analysis of the oil used is not known, but it was of the type that is commonly used for commercial heating. With this furnace, preheating was impossible due to the lack of a second furnace for this operation. The atmospheres studied in this furnace ranged from 3.5 per cent carbon monoxide to 9.8 per cent oxygen. Incidentally, when operating this furnace on the reducing side, considerable smoke was given off with the high reducing atmosphere, which was extremely annoying. The samples were allowed to remain in the furnace for a total time of 8 min., approximately 2 min. at heat. Surface carbons were determined in the usual manner and the results are given in Table IV. Contrary to generally accepted statements, it was found that here again the steel showed carburization instead of decarburization.

A third test consisted in using controlled-atmosphere furnaces for preheating and superheating. These furnaces. since they were electrically heated, offered a wide range of atmospheres without materially affecting the furnace temperatures.

TABLE III

Surface Carbon—Furnace Atmosphere Relationship, When Treating from Gas Fired Furnace

Atmosphere			Carbon Step Down Test		
CO_2	O_2	CO	First Cut 0.0000 to 0.0025 in.	Second Cut 0.0025 in. to 0.0050 in.	Third Cut 0.0050 in. to 0.0075 in.
9.0	0.0	2.5	0.79	0.75	0.75
8.8	0.0	3.0	0.78	0.75	0.73
8.4	0.0	6.3	0.77	0.74	0.74
5.7	0.0	7.8	0.75	0.71	0.71

Furnace heated with by-product coke oven gas. Preheated 1600 deg. F., 8 min. Superheated 2350 deg. F., total time 5 min. Sections 1 in. round x 3 in. long. Surface carbon of machined bar = 0.72 per cent.

TABLE IV

Surface Carbon—Furnace Atmosphere Relationship, When Treating from an Oil-Fired Furnace

Atmosphere			Carbon Step Down Tests		
CO_2	O_2	CO	First Cut 0.0000 to 0.0025 in.	Second Cut 0.0025 in. to 0.0050 in.	Third Cut 0.0050 in. to 0.0075 in.
12.7	0.0	3.5	0.80	0.75	0.74
14.1	0.0	2.2	0.77	0.76	0.75
15.0	0.0	1.0	0.79	0.75	0.74
15.1	0.3	0.0	0.78	0.74	0.72
14.5	0.9	0.0	0.76	0.74	0.72
8.0	9.8	0.0	0.81	0.76	0.74

Furnace fired with commercial fuel oil. No preheating employed. Superheated 2350 deg. F., total time 8 min. Section 1 in. round x 3 in. long. Surface carbon of machined bar = 0.72 per cent.

t Treated 18-4-1 Steel

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The fuel for atmosphere control was propane, having the following analysis (in per cent):

Ethane	2
Propylene	19
Propane	76
Butylene, Butane, Iso Butane, Iso Pentane	1.5

The first group of sections treated with this type equipment was preheated 20 min. at 1550 deg. F. in a 2 per cent carbon monoxide atmosphere. These sections were then superheated to 2350 deg. F. in atmospheres ranging from 15.8 per cent carbon monoxide to 9.3 per cent oxygen. The specimens were allowed to remain in the superheating furnace, regardless of the composition of the atmosphere, for a total time of 5 min., approximately 3 min. to come to heat, 2 min. at heat. After oil quenching, microsections were removed, and the remaining portion of the sections prepared for chemical analysis. The results of the chemical analysis (see Table V) showed that all test sections, regardless of the furnace atmosphere, were carburized. It is interesting to observe that the carburization produced in the oxidizing atmospheres, penetrated deeper than that obtained under reducing conditions.

A second group of specimens was treated from these controlled-atmosphere furnaces, but instead of using a reducing atmosphere in the preheat, a 2 per cent oxygen atmosphere was employed. Except for the oxidizing atmosphere in the preheat, this second group was treated identically to the first (see Table VI), and also showed that the oxidizing atmospheres produced more carburization than did the reducing atmospheres. Results of all the tests, i.e., those obtained in gas, oil and atmosphere-controlled furnaces, showed that some carburization took place when a temperature of 2350 deg. F. was employed. These findings were unexpected, and in some instances, contrary to some of the information appearing in the literature and some generally accepted statements regarding the behavior of this type of steel.

With the foregoing results at hand, it is only natural to ask, "Were the samples properly prepared for chemical analysis?" Throughout the work extreme care was taken in all operations to in-

TABLE V

Surface Carbon—Furnace Atmosphere Relationship, Controlled Atmosphere Furnace, Reducing Atmosphere Preheat

Atmosphere			Carbon Step down Tests		
CO_2	O_2	CO	First Cut 0.0000 to 0.0025 in.	Second Cut 0.0025 in. to 0.0050 in.	Third Cut 0.0050 in. to 0.0075 in.
4.0	0.0	15.8	0.86	0.72	0.72
4.5	0.0	15.1	0.82	0.73	0.72
5.1	0.0	13.8	0.80	0.71	0.70
5.8	0.0	12.5	0.75	0.70	0.70
6.8	0.0	10.6	0.79	0.71	0.70
7.6	0.0	9.4	0.79	0.72	0.73
8.8	0.0	7.4	0.84	0.73	0.72
10.3	0.0	4.8	0.79	0.74	0.73
11.5	0.0	2.9	0.79	0.72	0.73
12.2	1.1	0.0	0.87	0.77	0.76
10.6	4.3	0.0	0.85	0.78	0.75
9.5	5.6	0.0	0.89	0.77	0.77
8.3	7.9	0.0	0.84	0.77	0.75
7.4	9.3	0.0	0.87	0.77	0.75

Heated in controlled atmosphere, electrically heated furnace. Propane gas used for controlling atmospheres. Preheated 1550 deg. F., 2.0 per cent CO, total time 20 min. Superheated 2350 deg. F., total time 5 min. Sections 1 in. round x 3 in. long. Surface carbon of machined bar = 0.72 per cent.

TABLE VI

Surface Carbon—Furnace Atmosphere Relationship, Controlled Atmosphere Furnace, Oxidizing Atmosphere in Pretreat

Atmosphere			Carbon Step Down Tests		
CO_2	O_2	CO	First Cut 0.0000 to 0.0025 in.	Second Cut 0.0025 in. to 0.0050 in.	Third Cut 0.0050 in. to 0.0075 in.
4.4	0.0	15.5	0.92	0.78	0.73
5.8	0.0	12.8	0.78	0.75	0.72
6.7	0.0	11.1	0.80	0.73	0.72
7.5	0.0	9.8	0.84	0.75	0.72
8.8	0.0	7.6	0.83	0.77	0.73
10.0	0.0	5.0	0.84	0.76	0.76
11.1	0.0	3.6	0.88	0.79	0.77
12.7	0.5	0.0	0.90	0.78	0.76
10.9	3.0	0.0	0.89	0.79	0.77
8.9	6.3	0.0	0.92	0.83	0.78

Heated in controlled atmosphere electrically heated furnace. Propane gas used for controlling atmospheres. Preheated 1550 deg. F., 2.0 per cent O_2, total time 20 min. Superheated 2350 deg. F., total time 5 min. Sections 1 in. round x 3 in. long. Surface carbon of machined bar = 0.72 per cent.

sure against any possible error. To establish whether or not the procedure employed for obtaining turnings for analysis was being carried out without contamination, a section of annealed bar material which had been turned from 1¼-in. to 1-in. round was annealed in the lead pot without any preheating or superheating. Analyses were taken before and after the semi-annealing operation and it was found that the two carbon results agreed perfectly. To check further, several additional samples were put through all the operations, except the superheating. These operations consisted of machining, cleaning, preheating, oil quenching, lead annealing and acid cleaning. The surface carbon results, after the above operations agreed with that of the machined bar. Finally, two sets of seven samples were treated from a temperature of 2350 deg. F. from seven different atmospheres. Both sets were handled identically up to and including the cleaning in acid. Surface carbon analyses of one group was made as acid cleaned. The second group was polished with No. 1 French emery cloth to a metallic finish. This procedure was employed to eliminate any possible carbon pick-up which could result if the samples were not properly scrubbed after the pickling operation. It is commonly held that high carbon steel, when pickled in 1:1 HCl shows a black sooty deposit and this deposit is often referred to as "carbon smut." The carbon analyses of the set pickled in acid and those polished with French emery showed the same degree of carburization. With these necessary precautions taken to determine that chemical samples were properly prepared, it can be concluded that this steel actually carburizes during superheating under the different atmospheric conditions employed, and this carburization must take place either during the superheating or during the oil quench.

Water Quenching

Since there was a remote possibility that the aforementioned carburization might have taken place during oil quenching, a group of samples was heated under various atmospheric conditions to a temperature of 2350 deg. F., followed by water quenching. The temperature of the water prior to quenching was 150 deg. F., and the samples were allowed to remain in the water until black, after which they were removed and air cooled to room temperature. Analytical turnings were prepared in the usual manner, and the results are given in Table VII. These results again show carburization, and the same trend is seen in this as in the previous tests, i.e., the oxidizing atmospheres resulted in a deeper degree of carburization than the reducing atmospheres. This water treatment eliminated the possibility of the carburization taking place during the oil quench, and since it has already been established that no carburization takes place during the preheat, it remains as a natural

TABLE VII

Surface Carbon—Furnace Atmosphere Relationship, Water Treated from the Superheat

Atmosphere			Carbon Step Down Tests		
CO_2	O_2	CO	First Cut 0.0000 to 0.0025 in.	Second Cut 0.0025 in. to 0.0050 in.	Third Cut 0.0050 in. to 0.0075 in.
4.4	0.0	15.5	0.77	0.74	0.73
5.8	0.0	12.8	0.75	0.73	0.73
7.5	0.0	9.8	0.75	0.74	0.74
8.8	0.0	7.6	0.78	0.76	0.75
10.3	0.0	4.8	0.81	0.76	0.74
12.7	0.5	0.0	0.80	0.77	0.76
10.9	3.0	0.0	0.84	0.79	0.78
8.9	6.3	0.0	0.85	0.80	0.77

Heated in controlled atmosphere, electrically heated furnaces. Propane gas used for controlling atmospheres. Preheated 1550 deg. F., 2.0 per cent CO, total time 20 min. Superheated 2350 deg. F., total time 5 min., water treated. Sections 1 in. round x 3 in. long. Surface carbon of machined bar = 0.72 per cent.

TABLE VIII

Surface Carbon—Furnace Atmosphere Relationship, Heat Treatment by Cooperating Firms

Atmosphere			Firm A			Firm B			Firm C			Firm D			Firm E		
CO_2	O_2	CO	1st Cut	2nd Cut	3rd Cut	1st Cut	2nd Cut	3rd Cut	1st Cut	2nd Cut	3rd Cut	1st Cut	2nd Cut	3rd Cut	1st Cut	2nd Cut	3rd Cut
4.5 to 7.8	0.0	14.5 to 16.4	0.82	0.75	0.73	0.85	0.76	0.74	0.88	0.79	0.74	0.56	0.53	0.58	0.92	0.83	0.75
6.5 to 9.5	0.0	11.5 to 12.5	0.87	0.76	0.74	0.87	0.79	0.74	0.85	0.76	0.75	0.54	0.53	0.57	1.01	0.84	0.73
8.6 to 10.6	0.0	7.7 to 8.2	0.81	0.78	0.77	0.88	0.78	0.75	0.82	0.77	0.75	0.84	0.79	0.74	0.91	0.84	0.77
10.2 to 12.6	0.0	3.5 to 5.0	0.85	0.79	0.75	0.85	0.79	0.75	0.86	0.77	0.75	0.94	0.85	0.81	0.93	0.84	0.76
12.6 to 14.6	0.0 to 1.0	0.0	0.97	0.85	0.78	0.89	0.80	0.75	0.87	0.79	0.76	0.92	0.86	0.81	0.90	0.83	0.78
11.0 to 12.0	3.0 to 4.6	0.0	0.83	0.78	0.76	0.86	0.77	0.73	0.88	0.79	0.75	0.95	0.85	0.79	0.92	0.85	0.79
6.0 to 9.0	6.0 to 6.2	0.0	0.88	0.82	0.79	0.91	0.81	0.76	0.90	0.80	0.76	0.95	0.87	0.82	0.92	0.84	0.78

All firms used controlled atmosphere electrically heated furnaces. Sections were preheated 1550 deg. F. in approximately 2.0 per cent CO. Superheated to 2350 deg. F. in atmospheres indicated. Sections 1 in. round x 3 in. long.

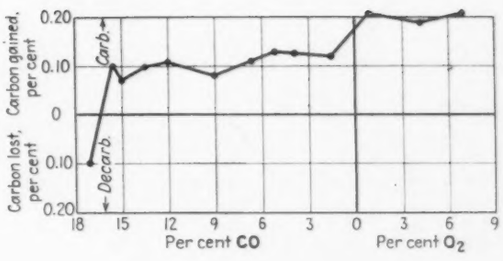
Firm	Fuel Analysis	Preheat Time, Min.	Superheat Time, Min.
A	Bottled propane	30	5
B	CO_2 4.5, O_2 1.7, CO 31.3; illuminants 8.2, CH_4 8.0, H_2 38.0, N_2 7.8	20	4
C	CO_2 6.4, O_2 0.9, CO 23.9; illuminants 9.7, paraffines 11.3, H_2 26.1, N_2 21.7	22	3½
D	CO_2 1.3, O_2 0.6, CO 8.8; illuminants 2.6, H_2 14.2, N_2 46.5	20	5
E	Propane	20	5

1st cut = 0.0000 to 0.0025 in. off surface. 2nd cut = 0.0025 to 0.0050 in. off surface. 3rd cut = 0.0050 to 0.0075 in. off surface.

conclusion that carburization must take place during the superheating operation.

Frankly, the carburization found in all of the foregoing tests was contrary to the supposedly known behavior of this steel during superheating, and consequently was unexpected. It was felt advisable to confirm these data by submitting test sections to several commercial heat treating firms who normally treat large quantities of high speed steel. The recognized ability of these firms, coupled with their many years of experience, served as a most practical check of the foregoing findings. Seven test sections were submitted to each of five firms and the atmospheres suggested were 16, 12, 8 and 4 per cent carbon monoxide, neutral, 3 and 6 per cent oxygen. The time in the superheating furnace was not specified, but it was suggested that all samples be held for the same length of time under each atmospheric condition. The preheating conditions were 1550 deg. F. in a 2 per cent carbon monoxide atmosphere. The results obtained on the test sections treated by these cooperating firms are shown in Table VIII. It should be observed that all test sections showed carburization, the only exceptions being the two samples treated by firm "D" in the highly reducing atmospheres. It is interesting to observe that the sections treated by firm "D" in approximately 16 and 12 per cent carbon monoxide decarburized. These atmospheres are generally believed to protect the steel more effectively than atmospheres which contain a lesser amount of carbon monoxide or which show free oxygen. To date, no reason has been found why these two samples, out of several hundred, showed decarburization. All of the foregoing results, together with many others, are shown in Fig. 14, which is a composite curve of sections treated from a temperature of 2350 deg. F. under various atmospheric conditions. The data plotted are based on the first cut ranging from 0.0000 to 0.0025-in. from the surface. These data include tests which were held from 3½ to 10 min. in the superheat and clearly indicate in the author's opinion what normally happens when 18-4-1 high speed steel is treated at 2350 deg. F. for times commonly employed, viz., that some carburization may be expected when the atmospheres range between 15 per cent carbon monoxide and 7 per cent oxygen.

FIG. 14—Composite curve of several hundred tests, including those treated by the cooperating firms. All tests treated from 2350 deg. F. Total time in the superheat furnace ranged from 3.5 to 10 min. Data plotted based on the first cut of 0.0000 to 0.0025 in. off the surface.



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Degree of Carburization

When microscopic examinations were made, the specimens were etched in a solution of alcohol containing 2 per cent nitric acid, commonly referred to as nital. When the carburization is of the magnitude as shown in all of the foregoing tests, it cannot be seen microscopically in the as-hardened condition. Fig. 15 shows the edge of a hardened section, and upon comparing this with Fig. 2, it will be seen that no difference in structure exists. Based solely on the as-hardened appearance, the conclusion would be that since the surface and the inside structures were identical, they would have the same chemical composition, but this is not necessarily true. The carburized area can be revealed by tempering in the range of 950 deg. to 1100 deg. F. The same microspecimen from which Fig. 15 was taken was tempered at 1050 deg. F., repolished, and the resulting structure is shown in Fig. 16. It will be seen that the carburized area consists of a white portion, which undoubtedly is high in retained austenite. The white area is followed by a mixture of martensite and retained austenite, and finally, by the normal structure. In the past, this structure was in some instances misinterpreted as decarburization. The difference between carburization and decarburization can be readily recognized by comparing Fig. 4 with Fig. 6, or with Fig. 16.

Moreover, decarburization can be recognized microscopically in either the hardened or the tempered condition, while carburization can be

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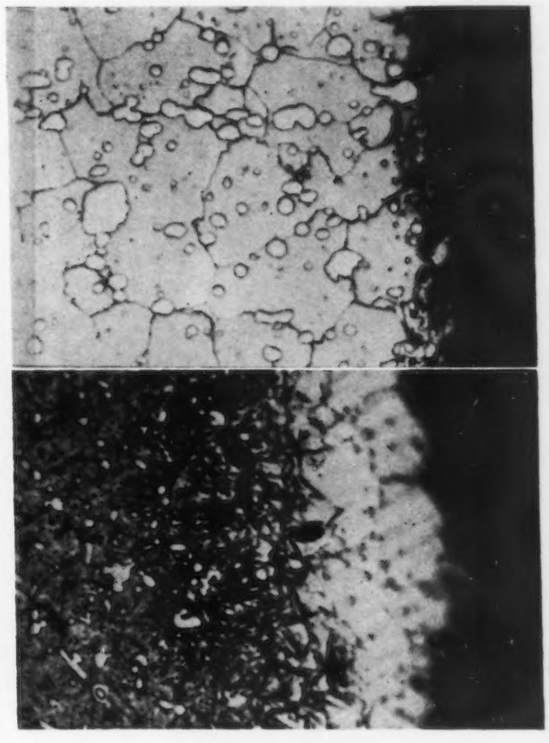

FIGS. 15 and 16—Effect of tempering on microstructure of a carburized surface. Fig. 15 (above) edge of an as-hardened section after oil treating from 2350 deg. F. At 1000 diameters. Fig. 16 (below) same as Fig. 15, after tempering at 1050 deg. F., showing carburization.

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TABLE IX

Surface Carbon—Furnace Atmosphere Relationship, Effect of Time at Heat

Atmospheres			Total Time in Superheat, 13 Min.			Total Time in Superheat, 18 Min.		
CO_2	O_2	CO	Cut 1 Per Cent	Cut 2 Per Cent	Cut 3 Per Cent	Cut 1 Per Cent	Cut 2 Per Cent	Cut 3 Per Cent
4.4	0.0	15.5	0.73	0.72	0.72	0.78	0.73	0.72
5.8	0.0	12.8	0.72	0.69	0.67	0.70	0.68	0.69
7.5	0.0	9.8	0.76	0.73	0.74	0.77	0.73	0.73
8.8	0.0	7.6	0.84	0.77	0.75	0.83	0.76	0.75
10.3	0.0	4.8	0.82	0.78	0.75	0.87	0.81	0.78
12.7	0.5	0.0	0.91	0.84	0.81	0.88	0.84	0.82
10.9	3.0	0.0	0.90	0.83	0.80	0.88	0.82	0.80
8.9	6.3	0.0	0.87	0.83	0.80	0.89	0.84	0.81

Heated in controlled atmosphere, electrically heated furnaces. Propane gas used for controlling atmospheres. Preheated 1550 deg. F., 2.0 per cent CO, total time 20 min.
Superheated 2350 deg. F., total time as indicated. Sections 1 in. round x 3 in. long.
Surface carbon of machined bar = 0.74 per cent.
1st cut = 0.0000 to 0.0025 in. off surface
2nd cut = 0.0025 to 0.0050 in. off surface.
3rd cut = 0.0050 to 0.0075 in. off surface.

TABLE X

The Effect of Time and Temperature with Constant Atmosphere on Surface Carbon

Oil Treating Temperature, Deg. F.	2 Min. at Heat			6 Min. at Heat			10 Min. at Heat			15 Min. at Heat		
	Cut 1	Cut 2	Cut 3	Cut 1	Cut 2	Cut 3	Cut 1	Cut 2	Cut 3	Cut 1	Cut 2	Cut 3
2000	0.74	0.71	0.72	0.70	0.66	0.67	0.64	0.63	0.65	0.57	0.59	0.62
2100	0.83	0.75	0.73	0.79	0.71	0.73	0.72	0.70	0.70	0.70	0.67	0.68
2200	0.97	0.85	0.77	0.85	0.77	0.74	0.83	0.75	0.74	0.79	0.74	0.72
2250	0.95	0.80	0.76	0.89	0.77	0.75	0.83	0.74	0.74	0.75	0.72	0.72
2300	0.94	0.80	0.76	0.91	0.79	0.76	0.83	0.74	0.74	0.83	0.75	0.74
2350	0.93	0.79	0.77	0.91	0.79	0.75	0.87	0.77	0.74	0.84	0.74	0.70
2400	0.89	0.77	0.76	0.88	0.71	0.69	0.80	0.72	0.69	0.72	0.66	0.65
2450	0.96	0.81	0.76	0.92	0.77	0.73	0.78	0.75	0.70	0.50	0.46	0.49

Specimens 1 in. round x 3 in. long. Preheated 1550 deg. F., 2 per cent CO atmosphere, total time 20 min.
Superheated to temperatures indicated in an atmosphere of 9.8 to 11.0 per cent CO.
Carbon analysis of machined bar prior to treating = 0.71 to 0.72 per cent.
Cut 1 = 0.0000 to 0.0025 in; cut 2 = 0.0025 to 0.0050 in.; cut 3 = 0.0050 to 0.0075 in.
Preheating and superheating in controlled atmosphere, electrically heated furnaces.
Propane gas used for controlling furnace atmospheres.

TABLE XI

The Effect of Atmospheres of 16 Per Cent CO or Higher

Atmosphere			Total Time in Superheat, 10 Min.			Total Time in Superheat, 20 Min.		
CO_2	O_2	CO	Cut 1, 0.0000 to 0.0025 in.	Cut 2, 0.0025 to 0.0050 in.	Cut 3, 0.0050 to 0.0075 in.	Cut 1, 0.0000 to 0.0025 in.	Cut 2, 0.0025 to 0.0050 in.	Cut 3, 0.0050 to 0.0075 in.
6.4	0.0	13.3	0.80	0.76	0.75	0.76	0.71	0.70
4.0	0.0	16.4	0.46	0.48	0.55	0.48	0.46	0.47
3.6	0.0	19.4	0.46	0.47	0.57	0.54	0.55	0.60
2.8	0.0	24.4	0.75	0.71	0.70	0.80	0.72	0.70
2.0	0.0	27.0	0.70	0.64	0.65	0.70	0.65	0.65

Specimens 1 in. round x 3 in. long, no preheat.
Superheated to 2350 deg. F. for total times indicated above.
Carbon analysis on machined bar prior to treating = 0.70 to 0.71 per cent.
Heat in controlled atmosphere, electric furnace. Propane gas + generated carbon monoxide used for controlling furnace atmosphere.

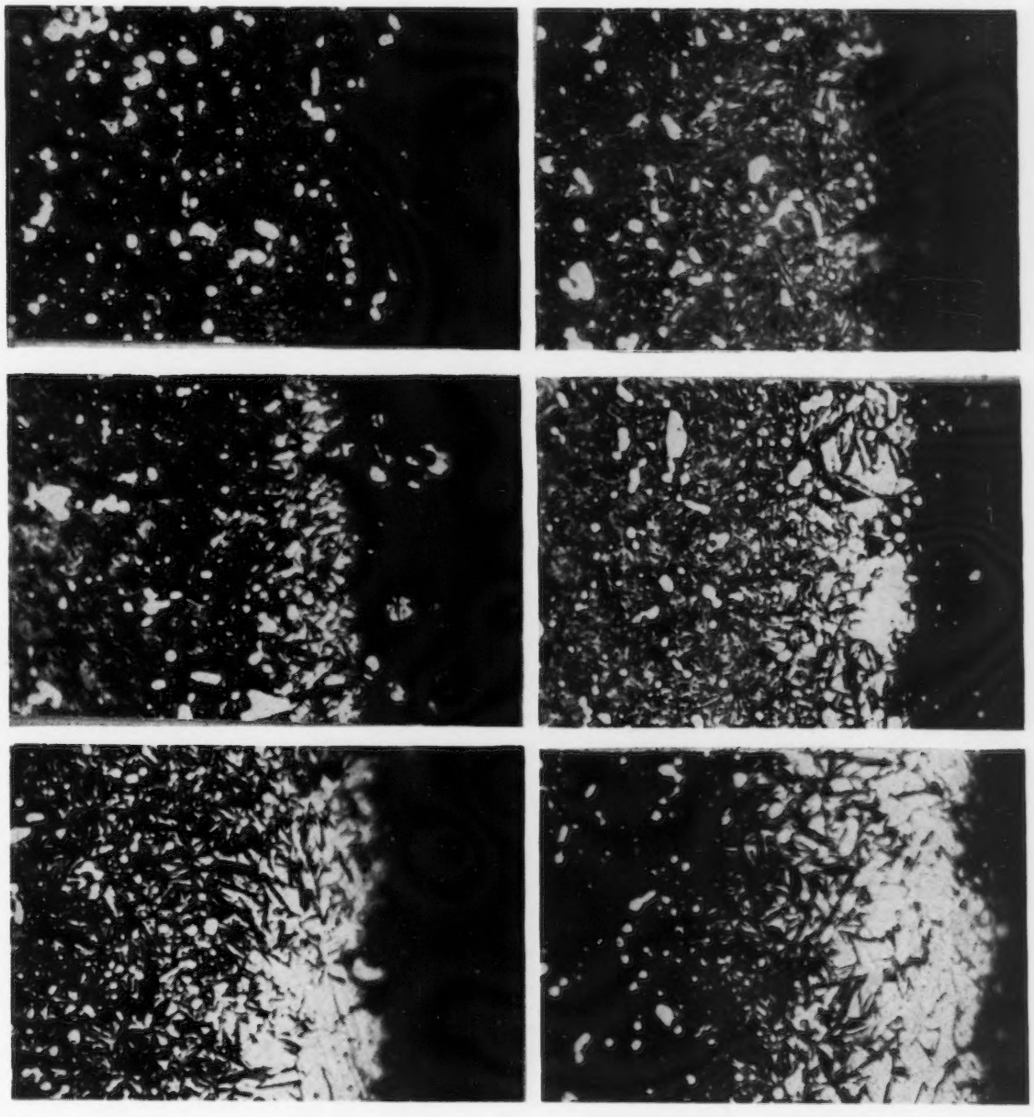
recognized only after tempering. The microscope, in addition to being useful in determining whether the surface is carburized or decarburized, can be used to a fair degree of accuracy to determine the degree of carburization. Figs. 17 to 22 inclusive show the surface of test sections which range from neutral to a high degree of carburization. These test sections were oil quenched from 2350 deg. F., tempered at 1050 deg. F., after which microspecimens were removed. The remaining portions of the test sections were then analyzed for surface carbon. This provided a means to correlate the degree of carburization as shown by the microscope with the actual increase in surface carbon, as determined by chemical analysis. Fig. 17 shows neither carburization nor decarburization, while Fig. 22 shows a high degree of carburization, and the effect of this carburization on the microstructure is very readily recognized. Figs. 18 to 22 inclusive show ascending degrees of carburization.

The Effect of Time

Data presented represent the results obtained when the tests were made at a temperature of 2350 deg. F. with a few minutes' soak. It is known that with certain types of tools which have heavy bodies and thin cutting edges, it is possible for the thin edges to reach furnace temperature before the heavy portions are at heat. For example, with a large hob, the teeth may reach furnace temperature 5 to 10 min. before the body, depending on the size of the hob. To obtain data for longer times, a number of test sections were preheated to 1550 deg. F. in a 2 per cent carbon monoxide atmosphere for a total time of 20 min., followed by superheating to 2350 deg. F. for a total time of 13 min., approximately 10 min. at temperature. These samples were examined in a manner similar to all previous sections, and the carbon results are shown in Table IX. It will be seen, except for the atmosphere range of around 13 per cent carbon monoxide, that all the samples showed carburization. Those treated in approximately 13 per cent carbon monoxide were neither carburized nor decarburized.

The same test was repeated, except that during the superheating period, the sections were in the furnace for a total time of 18 min.,

approximately 15 min. at heat. These results are included in Table IX, and again, except for the atmosphere of approximately 13 per cent CO, all samples showed carburization; i.e., the more oxidizing the atmosphere, the greater the amount of carburization that took place. As a matter of fact, those samples held in an atmosphere of approximately 13 per cent carbon monoxide for a total time of 15 min. at the superheat showed a tendency to cause decarburization, test sections from 10 different melts of steel were preheated to 1550 deg. F. in a 2 per cent carbon monoxide atmosphere, followed by superheating to 2350 deg. F. in a 10.2 per cent carbon monoxide atmosphere, and were held at heat from 2½ to 40 min., followed by oil quenching and tempering at 1050 deg. F. The size of the specimens for this test did not admit of chemical carbon analysis, but microscopic examination showed that all sections that were held at heat for 10 min. or less were carburized. Those held 15 min. at heat showed a neutral surface or a slight amount of decarburization. Tests held 20 to 40 min. at heat all showed definite decarburization, and the degree of decarburization increased with increase in time at the superheat. These data confirm those results shown in Table IX, i. e., this steel may be held at least 10 min. in this atmosphere before decarburization occurs. It might be well to mention that these data should be applied with some reservation since it is possible that other temperatures, types of furnaces, atmospheres, different fuels, etc., may show slightly different results.



FIGS. 17 to 22—Relation of the degree of carburization to microstructures. All oil-quenched 2350 deg. F., drawn 1050 deg. F. Surface carbon of machined bar = 0.72 per cent. Surface carbons after treating as follows: Fig. 17 (upper left) = 0.72 per cent; Fig. 18 (upper right) = 0.76 per cent; Fig. 19 (center left) = 0.81 per cent; Fig. 20 (center right) = 0.84 per cent; Fig. 21 (lower left) = 0.87 per cent; Fig. 22 (lower right) = 0.91 per cent. All shown at 1000 diameters.

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total time of 18 min., showed a slight amount of decarburization. In view of the length of time these sections were held at heat, it is the writer's contention that it is almost impossible to have decarburization occur during the usual heating of any size tool made from this type of steel if the atmosphere is kept in motion.

Since an atmosphere of 12 to 13 per cent carbon monoxide, with a

Effect of Temperature

The generally employed temperature for the heat treatment of this steel, as previously mentioned, will range from 2300 deg. to 2375 deg. F. However, there are certain types of tools which may be treated at lower temperatures, and in a few instances, higher temperatures are

occasionally used. To determine the effect of different temperatures and different soaking times, data were secured by treating ½ in. sq. sections at 1900 deg. to 2400 deg. F., in increments of 100 deg. F. The atmosphere employed in the preheat was 2 per cent CO; that in the high heat 10 per cent carbon monoxide. To make the test conclusive, material was taken from six different melts of steel. The length of time in the superheat ranged from 7 min. for the 1900 deg. F. to 2½ min. for the 2400 deg. F. treatment with proportionate times for the other superheating temperatures. All test sections were oil quenched, followed by drawing at 1050 deg. F., 1 hr. at heat.

These sections were examined microscopically for carburization or decarburization, and it was found that those sections treated from 1900 deg. F. showed decided decarburization, as shown in Fig. 23. Those samples which were treated from a temperature of 2000 deg. F. showed neither carburization nor decarburization, as shown in Fig. 24. When temperatures of 2100 deg. to 2400 deg. F. were employed, the samples all showed carburization; the amount of carburization increasing with increase in temperature, as shown in Figs. 25 to 28 inclusive. These data were found so interesting that it was decided to repeat the test, and to use specimens sufficiently large to obtain actual chemical analyses.

When the test was repeated, sections were held 2, 6, 10 and 15 min. at heat, at temperatures of 2000 deg. to 2450 deg. F., in increments of approximately 50 deg. F. The sections for this test were 1 in. round x 3 in. long, and were machined from bar stock 1¼ in. in diameter. All sections were preheated to a temperature of 1550 deg. F. in a 2 per cent carbon monoxide atmosphere, followed by superheating in an atmosphere of 10 to 11 per cent carbon monoxide. When sections were at their proper superheating temperature and after holding for the desired length of time, they were oil quenched, and subsequently examined for chemical carbon analysis. These data are shown in Table X, while the carbon results for the first step representing from 0.0000 to 0.0025 in. from the surface are shown graphically in Fig. 29.

An examination of these data shows some very interesting results. For example, the sections which were held for the shortest length of time all showed carburization; but, the lower the temperature, the greater the tendency for decarburization to occur. This confirms the data as represented in Figs. 23 to 28 inclusive, where decarburization occurred at 1900 deg. F., and excessive carburization at 2400 deg. F. It is also interesting to note that as the time at the superheat was increased, there was less carburization, and with the lower temperatures actual decarburization occurred.

These data were obtained with atmospheres ranging from 10 to 11 per cent carbon monoxide; however, from the shape of the curves as shown in Fig. 29, it is possible that other atmospheres, either higher or lower in carbon monoxide content might give different results.

TABLE XII

The Effect of Long Soaking Time on Surface Carbon

Atmosphere			Carbon Step Down Tests			
CO_2	O_2	CO	Cut 1 0.0000 to 0.0025 in.	Cut 2 0.0025 to 0.0050 in.	Cut 3 0.0050 to 0.0075 in.	Cut 4 0.0075 to 0.0100 in.
5.4	0.0	14.5	0.62	0.64	0.61	0.62
6.4	0.0	12.1	0.58	0.59	0.57	0.59
8.6	0.0	7.7	0.57	0.64	0.64	0.65
10.2	0.0	5.0	0.59	0.72	0.71	0.71
12.6	0.6	0.0	0.77	0.78	0.77	0.71
10.1	4.6	0.0	0.76	0.80	0.79	0.77
7.4	9.3	0.0	0.75	0.79	0.79	0.78

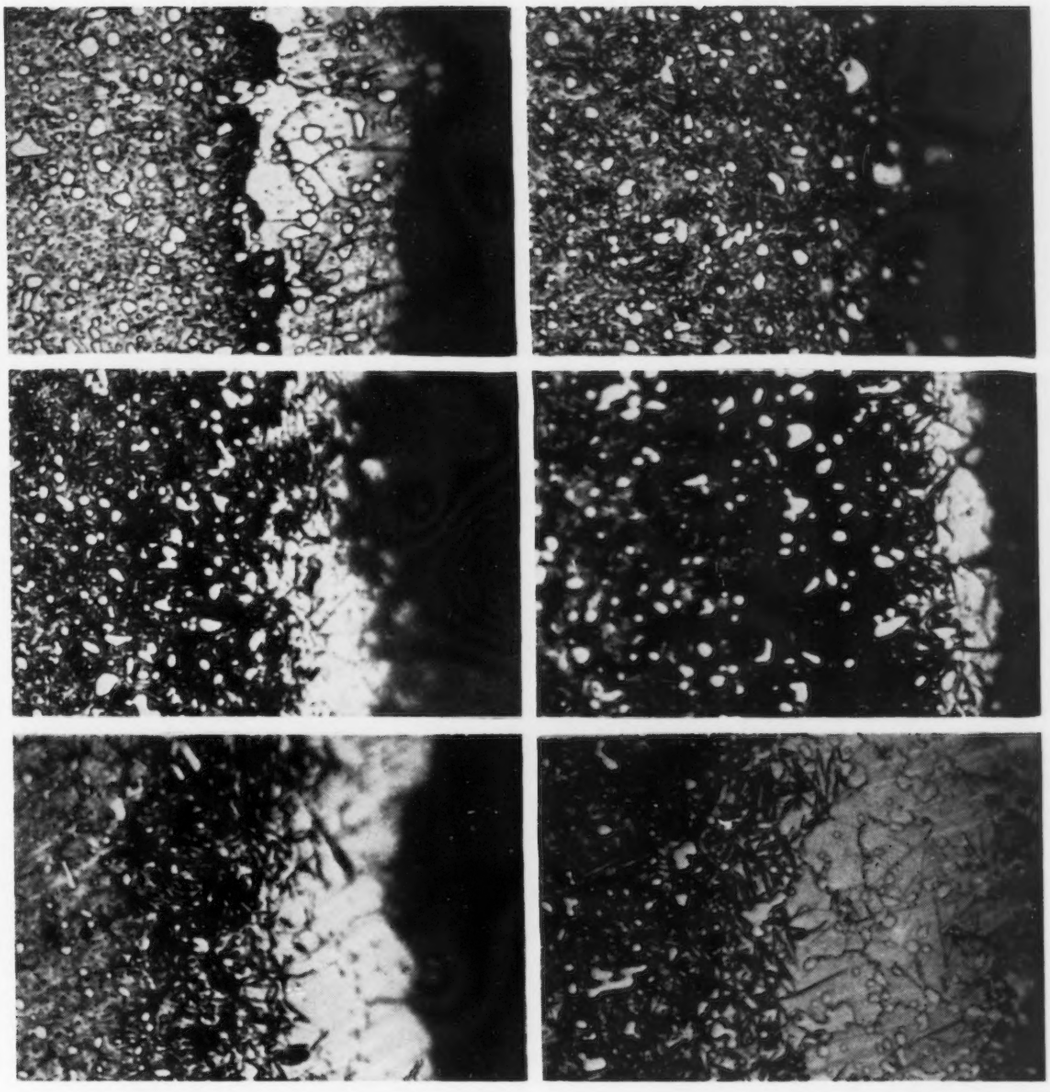
Specimens 1.5 in. round x 3 in. long, preheated 1550 deg. F., 2 per cent CO.
Total time 40 min.
Superheated 2350 deg. F., 0.5 hr., atmospheres indicated above.
Carbon analysis on the machined bar = 0.71 to 0.72 per cent.
Preheated and superheated in controlled atmosphere, electrically heated furnaces.
Propane gas used for controlling furnace atmospheres.

TABLE XIII

The Effect of Atmospheres on Size and Weight Change

Atmosphere			AS-Hardened 2350 deg. F., Total Time 5 Min.			AS-Hardened 2350 deg. F., Total Time 10 Min.		
CO_2	O_2	CO	Length Change, In.	Diameter Change, In.	Weight Loss, Gm.	Length Change, In.	Diameter Change, In.	Weight Loss, Gm.
3.7	0.0	16.3	+0.0009	+0.0004	0.132	+0.0016	+0.0006	0.078
4.8	0.0	14.3	+0.0009	+0.0006	0.154	+0.0015	+0.0006	0.207
6.9	0.0	11.1	−0.0002	−0.0008	0.564	+0.0006	−0.0011	0.883
9.3	0.0	5.7	−0.0007	−0.0015	0.737	−0.0015	−0.0036	1.428
11.2	0.0	3.5	−0.0013	−0.0019	0.912	−0.0031	−0.0038	1.895
12.0	0.9	0.0	−0.0016	−0.0032	1.200	−0.0048	−0.0068	2.832
9.3	4.1	0.0	−0.0020	−0.0040	1.581	−0.0060	−0.0081	3.439
			AS-Hardened 2350 deg. F., Drawn 1050 deg. F. Total Time in Superheat, 5 min.			AS-Hardened 2350 Deg. F., Drawn 1050 deg. F. Total Time in Superheat, 10 Min.		
3.7	0.0	16.3	+0.0011	+0.0004	0.229	+0.0021	+0.0010	0.154
4.8	0.0	14.3	+0.0011	+0.0007	0.203	+0.0017	+0.0004	0.264
6.9	0.0	11.1	+0.0022	−0.0006	0.712	−0.0008	−0.0010	0.998
9.3	0.0	5.7	−0.0006	−0.0011	0.845	−0.0018	−0.0030	1.550
11.2	0.0	3.5	−0.0010	−0.0019	1.032	−0.0031	−0.0040	1.952
12.0	0.9	0.0	−0.0012	−0.0025	1.278	−0.0062	−0.0068	2.884
9.3	4.1	0.0	−0.0016	−0.0032	1.715	−0.0065	−0.0082	3.597

Specimens 1 in. round x 1 in. long. Preheated 1550 deg. F., 2 per cent CO, 20 min.
Size change determined with a four-place micrometer. Weight change determined with standard analytical balance. After all heat treating operations samples mechanically cleaned by sand blasting.
Preheated and superheated in controlled atmosphere, electrically heated furnaces.
Propane gas used for controlling furnace atmospheres.



FIGS. 23 to 28—Effect of variable temperature with constant atmosphere on microstructure (edge). All specimens preheated in 2 per cent CO atmosphere superheated in 10 per cent CO atmosphere, drawn at 1050 deg. after oil quenching. Fig. 23 (upper left) oil quenched from 1900 deg.; Fig. 24 (upper right) oil quenched from 2000 deg.; Fig. 25 (center left) oil quenched from 2100 deg.; Fig. 26 (center right) oil quenched from 2200 deg.; Fig. 27 (lower left) oil quenched from 2300 deg.; Fig. 28 (lower right) oil quenched from 2400 deg. All at 1000 diameters.

The degree to which this investigation could be carried is almost unlimited.

Effect of 16 Per Cent Carbon Monoxide

Throughout this study, atmospheres of 16 to 16.5 per cent carbon monoxide gave inconsistent results. When atmospheres varied between 15.5 to 16.0 per cent carbon monoxide for usual treating times, carburization was generally found. When the atmospheres showed 16 per cent or higher, decarburization frequently occurred. To more thoroughly check this effect, a study was made using atmospheres of 13.3 to 27 per cent carbon monoxide. The size of the test sections was 1 in. round x 3 in. long. The limit of the carbon monoxide content in the controlled-atmosphere furnace, when using propane gas, was around 16 per cent. Consequently, the higher carbon monoxide atmospheres were obtained by using a separate carbon monoxide generator, in which hot air was passed over charcoal at a temperature of 1830 deg. F. This generated carbon monoxide was then added to the atmospheres in the electrically heated high speed furnace. The results of this test are given in Table XI, and it will be seen that when an atmosphere of 13.3 per cent carbon

TABLE XIV

Effects of Atmospheres on Elements Other Than Carbon

Atmosphere			Carbon Step Down Tests			Per Cent			
CO_2	O_2	CO	Cut 1	Cut 2	Cut 3	Silicon	Chromium	Tungsten	Vanadium
(As machined)			0.75	....	....	0.24	3.84	18.42	1.07
4.7	0.0	15.3	0.82	0.74	0.74	0.24	3.85	18.40	1.09
5.9	0.0	12.4	0.87	0.75	0.74	0.22	3.85	18.55	1.11
7.2	0.0	10.0	0.81	0.77	0.74	0.25	3.85	18.52	1.11
9.8	0.0	5.5	0.87	0.78	0.75	0.23	3.84	18.50	1.11
13.0	0.0	0.6	0.85	0.77	0.76	0.24	3.85	18.46	1.09

Specimens 1⅞ in. round x 5 in. long. Preheated 1550 deg. F., 2 per cent CO, total time 40 min.
Superheated 2350 deg. F., 5 min. at heat.
Analysis of elements other than carbon made on material from the first cut (0.0000 to 0.0025 in.)
Preheated and superheated in controlled atmosphere, electrically heated furnaces.
Propane gas used for controlling furnace atmospheres.

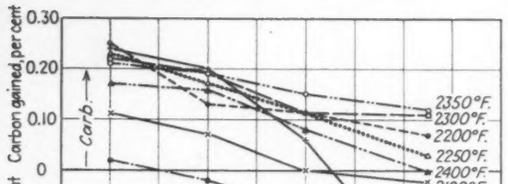


FIG. 29—Relation of a superheating atmosphere of 10 to 11 per cent CO to surface carbons within a temperature range of 2000 deg. to 2450 deg. F. All sections 1 in. round x 3 in. long. Preheated 1550 deg. in 2 per cent CO for a total time of 20 min.

FIG. 30—"Alligator skin" frequently obtained when treating from an oxidizing atmosphere. Note how the sharp cutting edges have scaled away.

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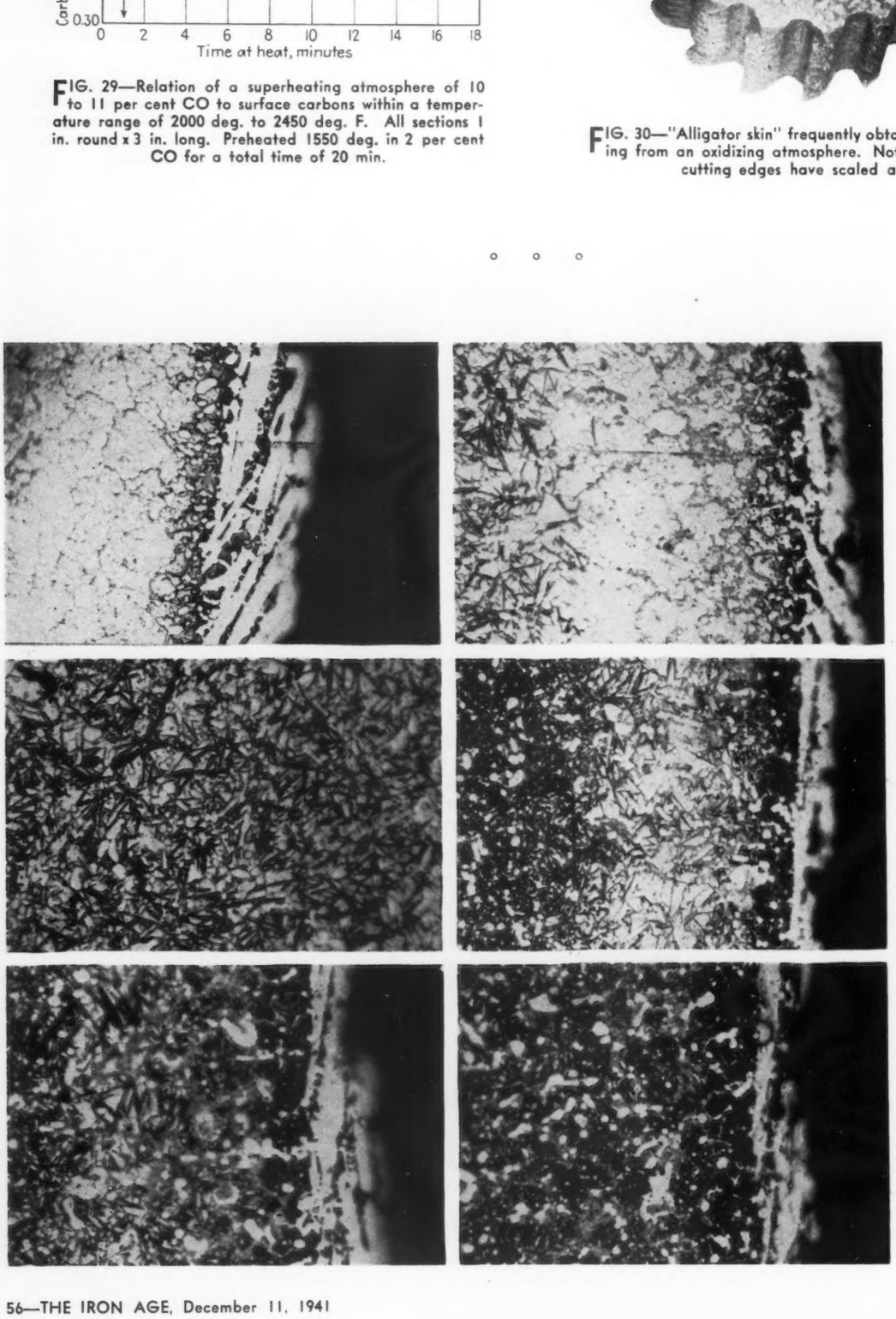

FIGS. 31 to 36—Effect of repeated tempering on microstructure of material carburized in wood charcoal. Fig. 31 (upper left) preheated in charcoal pack, 1600 deg., 6½ hr., oil quenched 2350 deg. Fig. 32 (upper right) same as Fig. 31, after tempering at 1050 deg. for 1 hr.; Fig. 33 (center left) same as Fig. 32, taken 0.0035 in. from edge of specimen; Fig. 34 (center right) same as Fig. 32, after a second draw for 2 hr. at 1050 deg.; Fig. 35 (lower left) same as Fig. 32, after a third draw for 2 hr. at 1050 deg.; Fig. 36 (lower right) same as Fig. 32, after a fourth draw for 16 hr. at 1050 deg. F. All at 750 diameters.

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monoxide was employed, the sections were carburized, while those treated in 16.4 and 19.4 per cent carbon monoxide showed very definite decarburization. When the percentage of carbon monoxide was around 24 to 27 per cent, the surface carbons were unaffected, being practically the same as in the machined condition. Undoubtedly an atmosphere containing 32 per cent carbon monoxide would again cause carburization, as has been established by atmospheres generated with carbon blocks.

What Atmosphere to Use

A review of all the data presented indicates that this steel is very difficult to decarburize, and the leaner the atmosphere as regards the percentage of CO present, the less the tendency toward decarburization. Strangely enough, the sections which were treated in oxidizing atmospheres showed the highest degree of carburization, and therefore, it might be erroneously concluded that this is the best atmosphere to use. For example, the data given in Table XII definitely shows that oxidizing atmospheres will carburize or produce a neutral surface more effectively than the reducing atmospheres. The data shown in this table were obtained on sections 1½ in. round x 3 in. long, which were preheated to 1550 deg. F. in a 2 per cent carbon monoxide atmosphere for 40 min., followed by superheating to 2350 deg. F. in the indicated atmosphere and held at heat ½ hr.

It will be seen that those tests made with reducing atmospheres all decarburized, while the sections which were treated in oxidizing atmospheres all showed a slight carburization. The inclination, therefore, would be to use oxidizing atmospheres to insure a carburized or neutral surface. Unfortunately, oxidizing atmospheres *cannot* be used for a large majority of tools, since these atmospheres cause sharp edges to become rounded, they frequently cause pitting and invariably lead to a surface which is often described as "alligator-skin" (see Fig. 30). In addition, oxidizing atmospheres cause an excessive amount of scaling which may often result in loss of size.

In the author's opinion, the surfaces obtained in oxidizing atmospheres are definitely unsatisfactory for the treatment of the majority of tools made from this type of steel. The influence of atmospheres on both size and weight change are given in Table XIII, and these data show that oxidizing atmospheres definitely increase the weight loss as compared to reducing atmospheres. From many hundreds of tests and from a careful examination of the surfaces of these tests, the atmosphere range which produces very satisfactory results and which can be obtained with many different types of furnaces is from 8 to 12 per cent carbon monoxide. Under the usual treating conditions, this atmosphere range will produce a slight amount of carburization, will materially reduce scale losses, and will prevent sharp edges from becoming rounded during the heat treating operations.

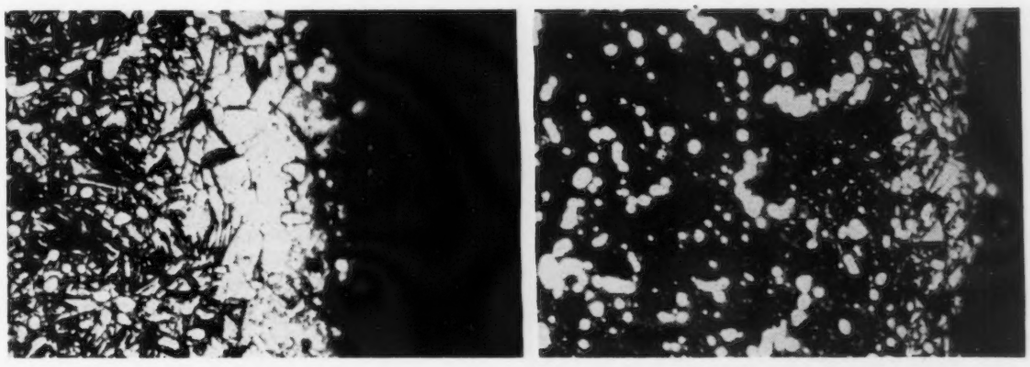
Effect of Atmospheres

In view of the behavior of carbon during the heat treatment of this steel, the logical question which follows is: "What effect does atmosphere have on the other elements?" Data were obtained to answer this question as follows: Sections 2 in. round x 5 in. long were machined to 1⅞ in. round. They were preheated to 1550 deg. F., in a 2 per cent carbon monoxide atmosphere for a total time of 40 min., and superheated to 2350 deg. F., being held 5 min. at heat in atmospheres ranging from 15.3 to 0.6 per cent carbon monoxide. Analyses were made before and after heat treatment for carbon, silicon, chromium, tungsten and vanadium. These data are given in Table XIV, which shows that the elements other than carbon, for all practical purposes, are unaffected by furnace atmospheres.

Effect of Drawing

The carburization which takes place during normal heat treating, as previously mentioned, cannot be seen in the as-hardened condition. Drawing at temperatures of 950 deg. to 1100 deg. F. for periods of 1 hr. or more reveal the carburized zone either as dark martensitic needles or frequently as a white band of austenite in which the dark needles appear. If the amount of austenite is relatively large, the austenitic areas near the edge will be free from large martensitic needles, but if an examination is made from the edge of the sample toward the uncarburized material, it will be found that these needles will eventually appear; invariably lying between the uncarburized material and the highly carburized zone.

It was believed that the carburization which takes place in normal heat treating would show the same characteristics as a section purposely carburized. To study the behavior of a carburized area more carefully and to have larger fields for investigation, a sample 1 in. round x 3 in. long was preheated to a temperature of 1600 deg. F. in a wood charcoal pack for a total time of 6.5 hr. (approximately 5 hr.



FIGS. 37 to 38—Effect of long time re-tempering on the microstructure of carburized material. This carburization took place during normal treating. Fig. 37 (left) oil quenched from 2350 deg., drawn at 1050 deg.; surface carbon as-machined = 0.74 per cent, as-treated = 0.89 per cent. Fig. 38 (right) taken from the same microspecimen as Fig. 37 after being re-tempered at 1050 deg. for 12 hr. Both at 1000 diameters.

at temperature). Following the carburizing preheat, the section was removed from the pack, and transferred to the high speed furnace, which was running at 2350 deg. F. The highly carburized surface was protected during the high heat treatment with a carbon block, and was held in the carbon block at the temperature mentioned for 10 min., followed by oil quenching.

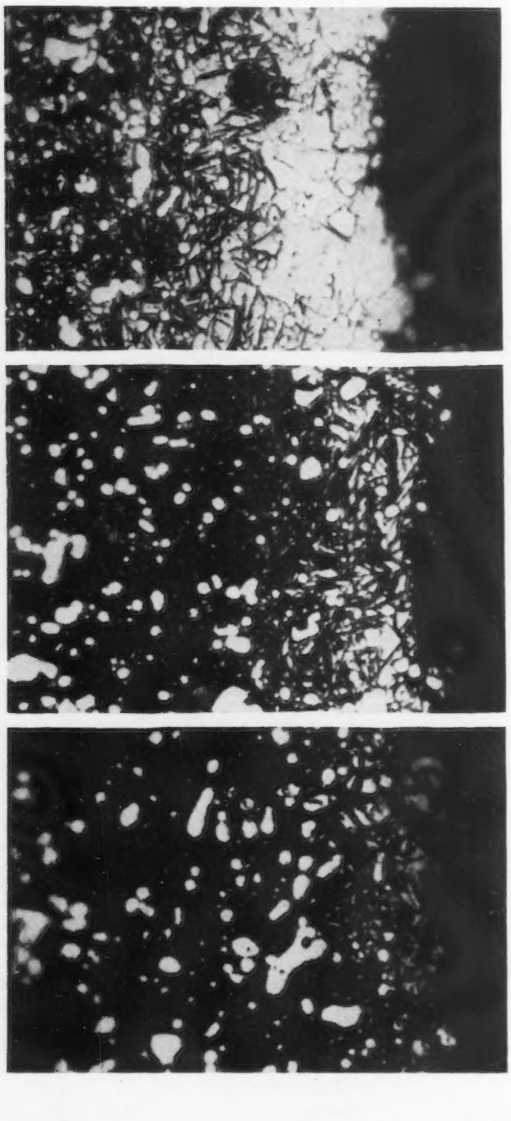


FIG. 39 to 41—Effect of triple tempering upon carburized material. Carburization took place during normal treating. Fig. 39 (top) oil quenched from 2350 deg., drawn at 1050 deg. Surface carbon on as-machined bar = 0.74 per cent, as-treated = 0.92 per cent. Fig. 40 (center) same as Fig. 39, after a second draw at 1050 deg. for 2 hr. Fig. 41 (bottom) same as Fig. 40, after a third draw at 1050 deg. for 2 hr. All at 1000 diameters.

Fig. 31 shows the structure of this carburized area in the as-hardened condition. The structure is identical with any normally treated 18-4-1 high speed steel except for the small amount of eutectic shown on the surface. The structure consists of the usual grain boundaries and excess carbides.

The same microspecimen was drawn at 1050 deg. F. for 1 hr., and the structure after this treatment is shown in Fig. 32. This photomicrograph shows that the eutectic was unaffected by tempering; directly back of the eutectic there is a field of austenite, and adjoining the austenitic field, the structure is composed of dark martensitic needles in retained austenite. The structure of these dark needles is better shown in Fig. 33, which was taken 0.0035 in. from the edge of the same microspecimen from which Fig. 32 was taken. The entire field is composed of dark needles in an austenitic matrix. This type of structure is frequently encountered when the quenching of high speed steel is interrupted. It must be stressed that the quench of this particular specimen was not interrupted since it was lying around in the as-hardened condition for two days before any miscroscopic examination was made.

The structures shown in Figs. 32 and 33 clearly indicate that the retained austenite has partially broken down. Incidentally, the structure of the specimen which was not carburized showed the usual drawn structure for this type of steel. The same microspecimen was given a second draw from a temperature of 1050 deg. F., 2 hr. at heat, total time 2½ hr. The structure after the second tempering operation, as shown in Fig. 34, indicates that the retained austenite transformed still further to martensite. The area which has been practically all austenite after the first draw has broken down and is now composed of dark martensitic needles in the austenite. The area directly in back of this austenitic band which showed martensitic needles in austenite on the first draw (see Fig. 33) is now composed of a mass of black needles after the second draw. The microspecimen was given a third draw at 1050 deg. F., 2 hr. at heat, total time 2½ hr. The structure after the third drawing operation, as shown in Fig. 35, indicates that the retained austenite has broken down still further. Finally, the microspecimen was given a fourth draw at 1050 deg. F. for a total time of 16 hr. The structure clearly indicates that all of the retained austenite has broken down into martensite, as shown in Fig. 36.

To correlate these various microstructures with the carbon content, surface carbon analyses were made on the 1-in. round bar from which the above microspecimen was taken. The results of these analyses (in per cent) on the diameter in steps of 0.005 in. follow:

Step 1=1.05; step 2=0.98; step 3=0.98; step 4=0.99; step 5=0.99; step 6=0.99; step 7=0.97; step 8=0.95.

The microscopic examination after the first drawing treatment showed that the eutectic averaged between 0.0007 and 0.0010 in.; the retained austenite averaged between 0.0020 and 0.0025 in.; and, finally, a mixture of retained and transformed austenite which is characterized by the black martensitic needles 0.025 to 0.030 in. The indications from these results are that in order to have retained austenite, the carbon content must be between 0.95 and 1.05 per cent. Partially transformed austenite as shown in Fig. 33 requires 0.90 to

0.98 carbon. The amount and nature of the black needles depends entirely upon the carbon concentration. When only a few needles appear, the carbon concentration is high; while when the entire structure shows a mass of black needles, the amount of carburization is small. A more detailed study of the relation between carbon content and microstructures appears to be in order. If specimens of sufficient size to insure enough sample for chemical carbon analysis can be heat treated without too great an amount of warpage, and if cuts of 0.0005 in. on the diameter can be obtained, a closer correlation between microstructure and carbon content might be established.

The foregoing study of a carburized section showed that the retained austenite due to high carbon concentration can be broken down on repeated drawing. Further confirmation of this observation was obtained on a section ½ in. sq. x 4 in. long, which was preheated to a temperature of 1600 deg. F. in a wood charcoal pack for a total time of 11 hr. After preheating, the section was oil quenched from 2350 deg. F. and 0.002 in. ground from the surface to remove the eutectic constituent. The Rockwell hardness as oil quenched was C-42 to 44; after drawing for a total time of 1½ hr. at 1050 deg. F., the Rockwell hardness was C-64 to 66. The Rockwell hardness after a second draw at 1060 deg. F. for 2 hr. was C-69 to 70. The same section was given a third draw at 1090 deg. F. for 2 hr., after which it showed a Rockwell hardness of C-68 to 69. These hardness results confirm the presence of retained austenite caused by high carbon concentration and its decomposition during tempering.

Returning to specimens which were carburized during normal treating from 2350 deg. F., a microspecimen was taken from a test which on chemical carbon analysis showed an increase in surface carbon of 15 points. Fig. 37 shows the structure as oil quenched and drawn at 1050 deg. F. for 1 hr. The structure shows a great deal of retained austenite and some dark martensitic needles. The same microspecimen was redrawn at 1050 deg. F. for a total time of 12 hr. The structure after this retempering operation is shown in Fig. 38, and by comparing the two structures, it is readily seen that a large percentage of the retained austenite broke down, during the second tempering operation.

A second sample which showed an increase in surface carbon of 18 points was studied, and Fig. 39 shows the structure of the edge after oil quenching from 2350 deg. F., and tempering at 1050 deg. F. for 1 hr. Fig. 40 shows the edge after retempering for a 2-hr. period at 1050 deg. F. Fig. 41 shows the structure of the same sample after a third tempering operation for 2 hr. at 1050 deg. F. and shows a small amount of untransformed austenite. Examination of this specimen after the third drawing operation showed that there were only two or three small areas which had retained austenite, the area as shown in Fig. 41 being the largest. Practically 95 per cent of the retained austenite as shown in Fig. 39 transformed during the second and third tempering operations.

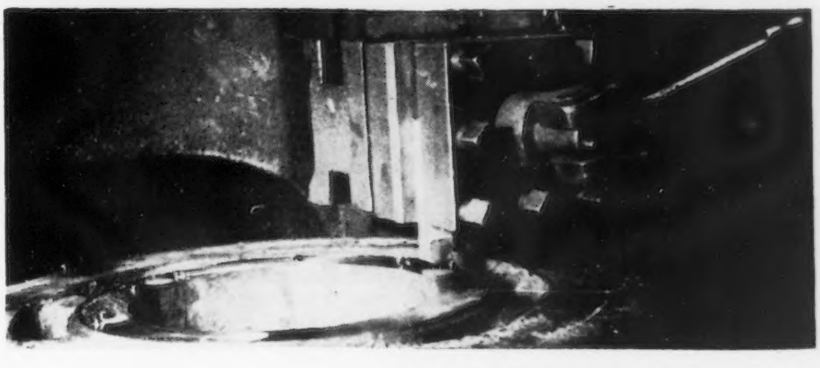
On numerous occasions it has been reported that double drawing increases tool life. The behavior of the retained austenite during tempering, which is caused by carburization, may be a partial answer to this observation. It has just been shown that the rate at which retained austenite decomposes depends upon the carbon concentration. When the amount of carburization is small, a double draw at 1050 deg. F. is sufficient to break down the retained austenite. However, when the carburization is relatively high, as shown in the above two instances, the time or the number of drawing operations must be increased to cause the retained austenite to break down. It might be well to mention when making microscopic examination of material carburized during heat treating, that the carburized constituent will etch faster than the uncarburized material. It is possible by carefully noting the edge of the microspecimens to tell with the unaided eye whether or not it is carburized due to the difference in shading. Further study of the behavior of this retained austenite as affected by tempering is warranted.

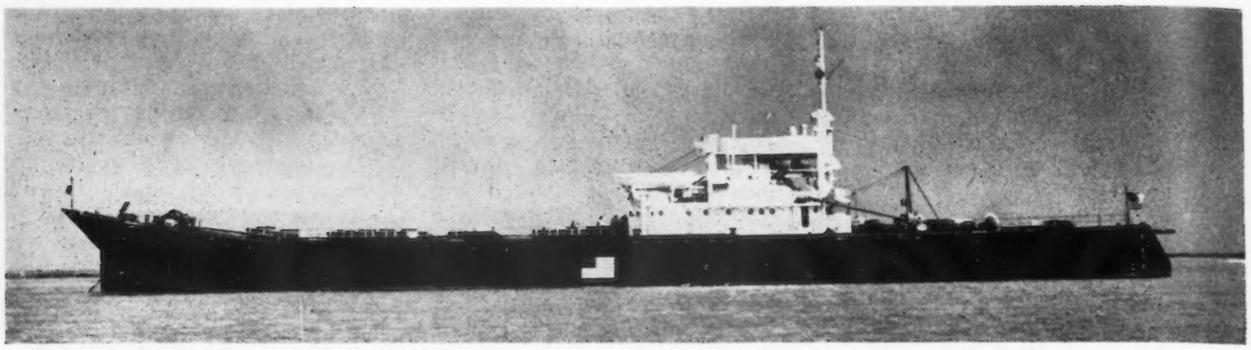
Ed. Note: Next week the author concludes with data on miscellaneous furnace treatments, salt bath heat treating, etc.

Carbides Turn 550-Brinell Steel

CUTTING production time in half, Stearns-Stafford, Inc., Lawton, Mich., is now producing manganese steel railroad turntable wheels of 550 Brinell hardness by machining with carbide tools instead of grinding. In machining these cast wheels which range from 14 to 20 in. in diameter, Carboloy 883 (tungsten carbide type) tools are being used, rather than the more usual 78B (tantalum-titanium type) designed for steel cutting. One reason for this is the higher abrasion resistance of the straight tungsten carbides as compared with the tantalum and titanium tungsten carbides commonly used for steel cutting.

In machining the wheels, they are first faced on both sides and bored on a vertical boring mill. Then the wheel is pressed onto an axle shaft and the assembly mounted in a large engine lathe, with one end of the shaft chucked, and the other supported in the tail stock, for rough and finish turning. In turning the wheel, a light cut (approximately 1/16 in. depth and 0.020 in. feed) is first used to remove the pitted surface material and take care of casting runout. Following this operation a deeper cut is used. Cutting speed is relatively low—around 45 ft. per min. —to reduce chances of shock breakage due to hard manganese spots and surface pitting of the casting.





Sea Otter II Welded From Wide Strip

CONSTRUCTION of the *Sea Otter II*, novel experimental cargo carrier developed by the U. S. Navy Department as a possible answer to the submarine threat, was made possible by use of electric arc welding, used exclusively in the fabrication of the hull and other steel parts. This unusual ship, illustrated above, which has undergone exhaustive tests by the Navy Department, represents an attempt to reduce shipbuilding to real quantity production by simplification of the hull design and by application of arc welding to speed production. Tests were so successful that the Navy Department has formed a corporation to build this type of vessel exclusively.

Although the details of the ship and the plans for utilization of a fleet of them if further tests prove successful are clouded in secrecy, some very interesting things are known about the *Sea Otter II*. Originally, it was intended that the ships should have no permanent hatches whatsoever in the hull, to provide for admission and removal of the cargo. It was proposed that a new type of simple hatch cover be securely arc welded in place and cut off without danger to the cargo. Then it could be rewelded in place.

The ship test proved so successful that it was decided to use the ships on round trips rather than to dismantle them for scrap at the end of the first crossing. Hence the *Sea Otter II* and all future ships of this design will have permanent hatches but not of the conventional type. A radical departure in hatches is reported. The ship's 16 gasoline engines also will be left permanently in the ships. These changes all were made because of the extraordinarily good results obtained in test runs.

The *Sea Otter II* was constructed by the Levingston Shipbuilding Co. of Port Orange, Texas. The vessel, which has a length of 250 ft., beam of 40 ft. and depth of 21 ft., is of all welded construction employing wide strip steel from continuous rolling mills. They require no bending or forming except at the bilges. The simplicity of the design, plus the fact that arc welding was used for speed and strength, permitted launching of the vessel in six weeks time, at a cost of $250,000. It is expected that this production time may be reduced still further as experience is gained in building later models. Produced in quantity, the boats should not cost more than $150,000 apiece fully fitted out.

The main hull plates are of ⅜-in. steel and the flat keel is constructed of ½-in. plates. The bottom side and deck plates are stiffened with longitudinal stiffeners. There are no transverse ribs or frames except intercostals, which are used to stiffen the longitudinals every 10 ft. These intercostals are welded between the longitudinal stiffeners. Nine transverse water-tight bulkheads are welded inside the hull. All welding equipment used by Levingston was supplied by the Lincoln Electric Co. of Cleveland.

The draft of the ship is 11 ft. fully loaded and it is thought that this, plus the fact that the *Sea Otter* sets relatively low on the water and is far less visible than other types of cargo carriers, will make the ship a poor target for a submarine. It is well known that a torpedo must be set at a depth which insures its run being free of wave effect, or for ocean going setting considerably more than 11 ft.

The vessel in loaded condition is so low in the water that in heavy weather at sea her decks will be awash most of the time. Arc welded construction was utilized to enable the craft to withstand this strain, plus the shock of possible near-hits by aerial bombs, better than other types of construction, because it has been proved that welded plates only buckle rather than split at the seams.

The ship is propelled by 16 automobile engines of 110 hp. apiece. These are arranged radially in groups of four, coupled hydraulically to a propeller. The four pro-

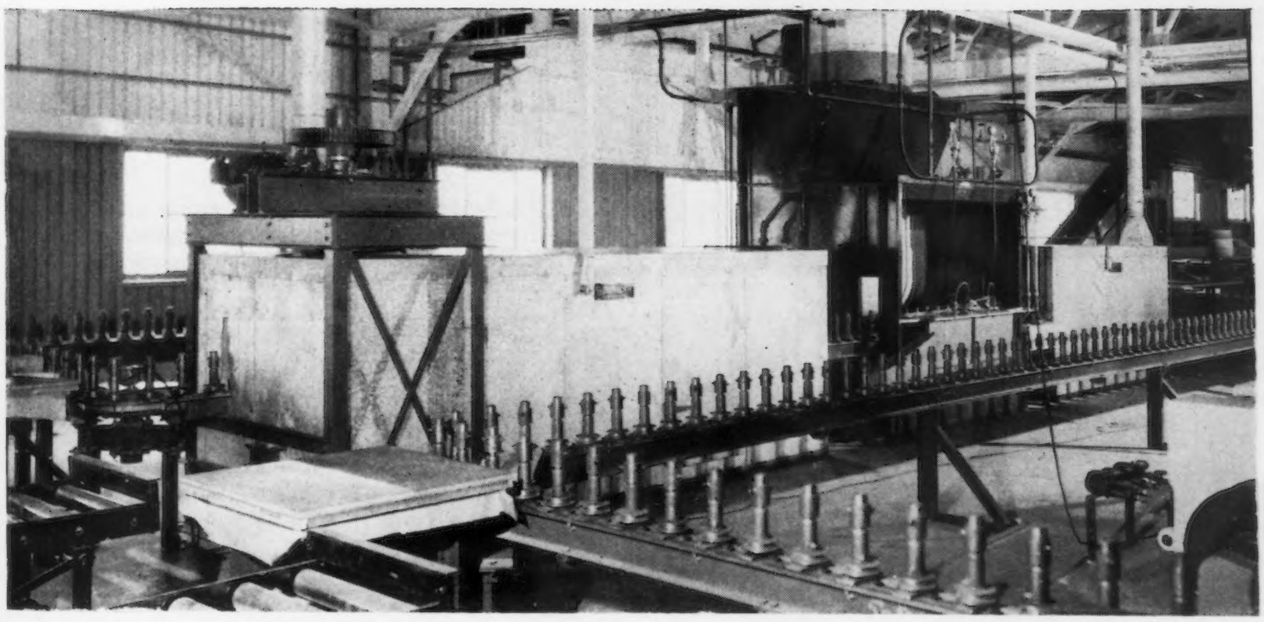
peller shafts descend vertically into the water in much the same manner as outboard motors, except that the transmissions are inside of cylindrical wells and the propellers are located just aft of amidships. The motors and propellers may be lifted into the vessel for repairs while under way and spare propellers and engines will be carried. The ship is equipped with degaussing cables and generators for magnetic mine protection.

The ship has a cruising radius of 7000 to 9000 nautical miles and a sustained speed of 12 knots. For short cruises, however, the vessel has sub-divided tanks to carry 95 tons of fuel and will have a cruising range of 3700 miles at 12 knots. She has a hold capacity of 122,800 cu. ft.

It is hoped that large numbers of the ships built in quantity production with arc welding will break entirely Hitler's blockade of the British Isles.

Spray Coating Shell Automatically

AUTOMATIC spray painting equipment continues to play a vital role in the general speedup of defense manufacture. Shown to the right is an interesting installation at the Budd Wheel Co. plant, Detroit. This view, made in the Budd shell shop, is of the general painting line for all shells turned out by the Budd company. A row of DeVilbiss rotary-type automatic spray machines for shells appears at the right, while the shell inspection bench is shown at the left.



BINKS automatic spray painting equipment is coating the outside of shells in sizes ranging from 20 to 105 mm. at the rate of 1000 per hr. in several large shell loading plants of the U. S. Ordnance Department. The shells are placed on spindles which are mounted on a long conveyor chain. Simple masking rings and plugs are used to protect threads from being coated. The loaded spindles first pass through a preheating oven which removes all trace of moisture and from there the shells are carried directly into a Binks Dynaprecipitator water wash spray booth. Here the spindles are revolved rapidly as they come in front of the spray guns, which operate only when a loaded spindle is in front of them. The freshly coated shells are next carried into a drying oven, from which they emerge 4 min. later completely dried. In this way a shell is completely coated and dried every 3.6 sec.

How to Choose A.C. A

IN the second and concluding part of the article begun in the issue of Dec. 4, the author discusses parallel operation of transformer type welders and describes the use of special control devices. Differences in technique between a.c. and d.c. welding are then pointed out. To make the series all inclusive, the author ends up with descriptions of some a.c. systems only infrequently used as well as those to be avoided. An appendix describes a method of calculating kva. and power factors of a.c. welding loads. The reader is also referred to an earlier series by Mr. Wyer on the choice of d.c. arc welding apparatus (THE IRON AGE, Aug. 7 and 14, 1941).

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PARALLEL operation of arc welding transformers to get increased current output for one arc can be very easily arranged. This fact provides extra latitude in selecting welder size, which can be based on the most common welding job, with paralleling to take care of the occasional very heavy job.

Any two arc welding transformers having the same open circuit voltage will operate successfully in parallel. Except as noted below, there is no necessity for keeping their settings equal, since each will deliver only the current for which it is set. Neither unit should be set to deliver more current than it could handle in separate operation, but current setting may be varied on either unit at any time.

[*NOTE: The above comment does not apply to those types of units where current adjustment is obtained by changing taps (by means of plugs or switches) which also change the open-circuit voltage of the secondary. These welders should always be set on the same tap when operated in parallel, and their settings should not be changed while either unit is energized.*]

The only precautions which must be taken in paralleling suitably matched transformers are to make sure that both (or all in case more than two are paralleled) are connected to the same polarity and that corrected-power-factor units are not excited from the secondary side.

Where more than one phase of the a.c. power supply are available, care must be taken to see that all transformers to be paralleled are connected to the same phase. Their polarity can then be easily checked as follows: Connect both primaries to the power line, and run a common connection to the work terminals of both secondaries. With the primaries both energized, measure the voltage between the electrode leads. If it is more than 10 or 15 volts, reverse the connections of the primary of one unit, and recheck.

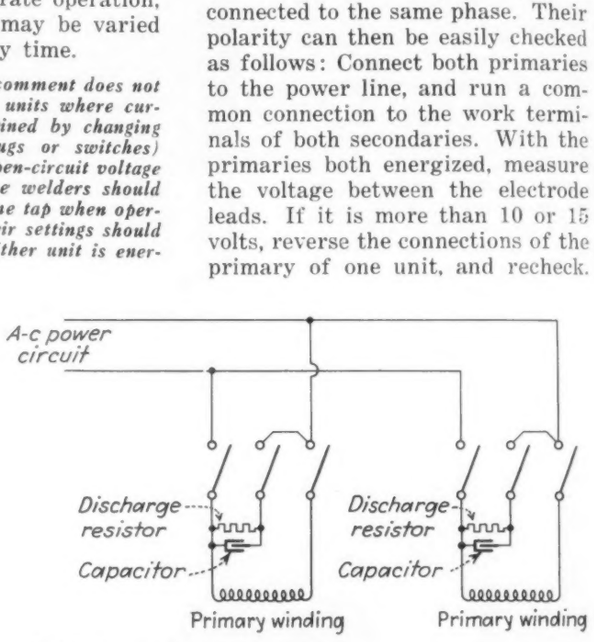

FIG. 9—Method of connecting primaries of transformers to be paralleled. The extra (middle) switch blade permits breaking the capacitor circuit.

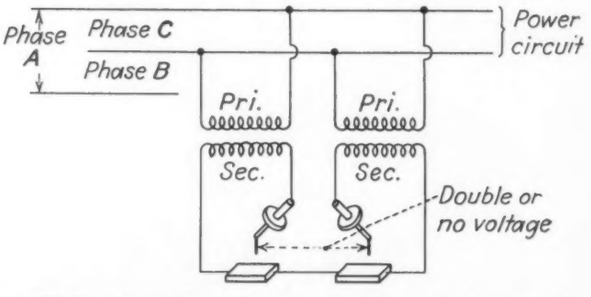

FIG. 10—When two transformers are connected to the same phase of a power line, the open-circuit voltage existing between the two electrodes will be either negligible or double the normal voltage of one unit, depending upon whether the connections to the line are of the same or of opposite polarity.

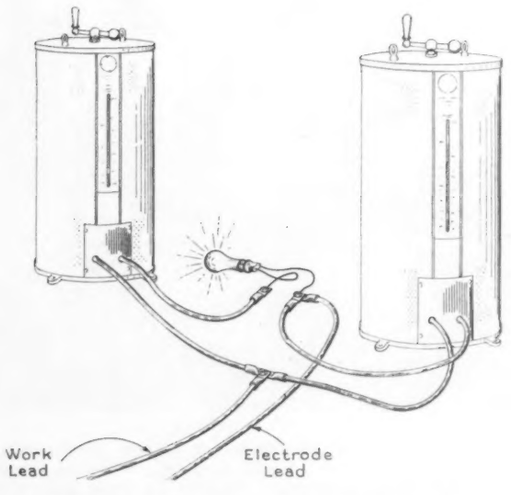

FIG. 8—Method of checking polarity of transformers before parallelling. If lamp does not light, polarity is correct.

Arc Welding Equipment

A lamp may be substituted for a voltmeter in this test, as illustrated in Fig. 8. If the lamp (be sure it is good) does not light, the connections are all right; if it lights up, connections of one primary should be reversed. When proper polarity of connections has been checked, the electrode leads may be connected together.

In the case of transformers having built-in power factor correction, or those where capacitors are connected across the primary leads, a single primary should not be disconnected without disconnecting the others when the secondaries are connected together. Otherwise, the disconnected unit will be energized through its secondary by the other welder or welders, and this must be avoided, The easiest way to prevent this is to feed both (or all) primaries through one disconnecting switch. If this is not feasible, the disconnecting switches should be three-pole units each arranged

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to disconnect the capacitors from the windings as well as disconnecting the primary from the power circuit. The proper connection is shown in Fig. 9. A discharge resistor should be connected in parallel with the capacitors to prevent their retaining a residual charge after they are disconnected.

When a number of units, not connected in parallel, are used on the same work piece or with the same work lead connection, voltages may exist between their electrode holders. If they happen to be connected to the same phase and with the same polarity, the voltage between them will be negligible. If connected to the same phase but with opposite polarity, the open-circuit voltage between them will be twice the open-circuit voltage of one unit (Fig. 10). If connected to different phases, as in Fig. 11, the phase voltage difference will exist between the electrode holders; this will be either approximately normal open-circuit voltage or about 1.73 times normal open-circuit voltage, depending on the relative polarity of their connections. This condition is similar to that which applies in a.c. welding, where two single-operator circuits connected to the same job will show a very low voltage or practically double normal voltage between electrode holders, depending on whether they are set for the same or opposite polarities.

In no case will interference between arcs result from the operation of two or more welders on the same work, provided that adequate work lead connections to both transformers are maintained. Only in the case illustrated in Fig. 12, where poor (high impedance) connections exist between the work and the common work lead connec-

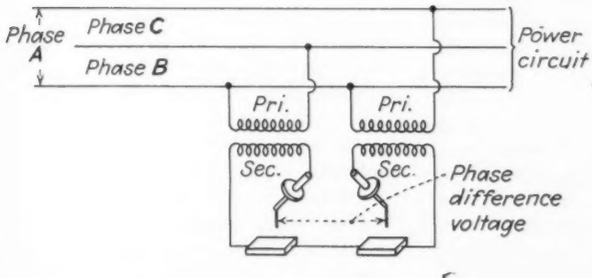

FIG. 11 — When welding transformers are connected to different phases of a three-phase line, the phase voltage difference will exist between the electrode holders.

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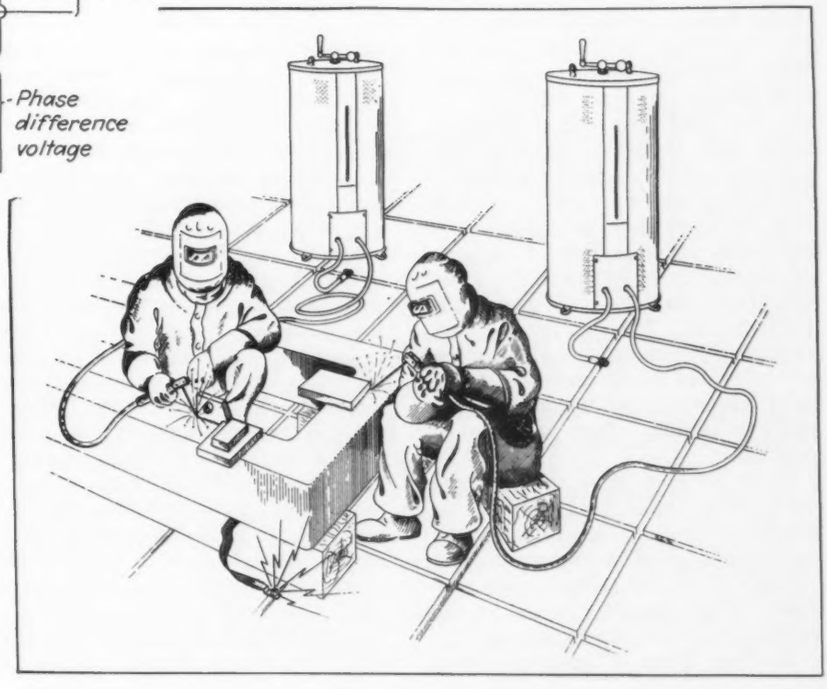


FIG. 12—Poor connection from work to common ground results in interference between arcs.

tion of the transformers, will any interference between the arcs be observed. In this specific case, which can be prevented by care in maintaining the good connections necessary for proper welding, the two arcs are in series, and interference between them will result. The remedy is to improve the connection between the work and the transformers, or to run separate work leads from the transformers to the work itself.

Special Control Devices

Remote control of the welding current, and automatic reduction of open-circuit voltage can be obtained by the application of additional control devices to some transformers.

Remote control, usually used on the larger ratings for machine welding, is provided by a "Raise-Lower" pushbutton which controls a motor driving the current adjusting mechanism of the transformer. It permits the operator to preset the welding current without leaving his work location, or to adjust the current while the arc is operating.

Automatic voltage reducing control can be applied to any transformer welder to reduce the voltage on the electrode to approximately one-third normal when the arc is broken at the end of a weld. This is accomplished by a system of relays actuated by the welding current itself, and extra leads to the welders' location are not required. A number of such devices are in use, and they are mentioned in National Safety Council Pamphlet No. 105 on "Electric Arc Welding." While they do reduce the open-circuit voltage during a large part of the time that the arc is not in operation, they should not be regarded as a substitute for continual carefulness on the part of the operators, because they do permit normal open-circuit voltage to appear on the electrode holder for a short time (such as 2 sec.) each time the arc is broken. This lag is necessary because an instantaneous operation of the relays would make it practically impossible to strike the arc and to obtain fast, economical operation.

Even with a time delay, some users have found that voltage reducing control does make it hard to establish a good working arc and consequently sometimes causes flaws in the deposited metal at the point where the arc is struck.

Another form of special control may be arranged to disconnect the welder from the line when no welding is being done, and to connect it again when operation is resumed. Such control removes all voltage from the electrode holder except during welding, but has the disadvantages of requiring an extra control circuit (whose conductors may be molded into a special electrode cable) and a push button, usually located in the handle of the electrode holder. Operators often object to this arrangement since it requires that constant pressure be maintained by thumb or fingers on the control button. A maintaining-contact switch such as a snap switch would be useless for this application because of the certainty that it would frequently be left in the energized position, thus defeating its own purpose.

D.C. vs. A.C. Welding Technique

Little difference exists in the actual operation of a.c. and d.c. arcs. To an operator accustomed to d.c. welding and depending on sound for part of his indication of arc action, the change to a.c. will be noticeable in that the sound of the arc is quite different. When its hum has become familiar, however, no troubles are caused by the change. As a matter of fact, most operators working on heavy work who have become accustomed to both types welding much prefer to use alternating current. The main reason for this is the absence of difficulties due to magnetic blow; it is not necessary for the operator to fight this condition as is frequently the case in d.c. welding. Fig. 13 is an example of heavy work of this character. As a result of the absence of blow, where procedure control will permit, it is quite common to increase the welding current very materially over what was used with direct current, and often to go to a larger size electrode. The net result is that more work is accomplished in a day, with less fatigue.

About the only difference in technique required is in starting a new electrode on vertical work. Where the d.c. arc, particularly when fed from a single-operator set, produces a heavy surge of heat at the moment the arc is struck and thus quickly bites into the metal left by the preceding electrode, with alternating current the surge is not so apparent. The usual practice is, therefore, to hesitate for just a moment after the arc is struck, instead of immediately beginning the arc travel. During this brief period, which is usually only long enough to permit one or two drops of metal to fall from the electrode, the bead is preheated by the arc so that when deposition of metal is begun by the usual technique, there will be good fusion between it and the preceding deposited material.

On light work in particular, the statement is frequently made that alternating current gives less penetration than direct current. Penetration depends on so many factors, however, that it is difficult to tie it down to the current characteristics. Undoubtedly a very large difference in penetration will be noted when a change is made from a reverse polarity d.c. electrode having an unusually high penetration characteristic to one of the a.c. rods. In general, these latter electrodes have less tendency toward extreme penetration, and consequently this change would probably be due more to the change in electrode than to the change in the power supply.

A few further comments about safety are in order because a fear of a.c. equipment has been built up in one way or another among some welding operators. The fact is that any electric welding circuit should be treated with respect and care, regardless of whether it is connected to a.c. or d.c. equipment. Accidents have happened with both, and accidents can be prevented by proper care and by respect for safety regulations. A safe rule is never to intentionally place yourself across any welding circuit and to use only equipment and accessories in good condition. Any defect in insulation of electrode holder, cable, or other accessories should be reported immediately, and the equipment should not be used until repaired or replaced. Gloves should be kept dry, and none but insulated electrode holders should be used.

Multiple-Operator Systems

Although d.c., constant-potential, multiple-operator welding systems are being used with good results in certain fields, a.c., constant-potential, multiple-operator welding systems have been used to a very limited extent. In such systems, a low-voltage welding power distribution circuit, either three phase or single phase, is used to distribute power to various locations in the welding shop. This circuit is fed by a constant-potential transformer having a secondary voltage of normal open-

circuit voltage, such as 80 volts. At each welding location, reactors or transformers may be used to regulate the current to the arc.

The system is thus practically identical with the constant-potential multiple-operator, d.c. welding system frequently encountered in shipyards. While for such special applications where duty factors are very low and where a number of low-current arcs are concentrated in a small area, this system has advantages, it is doubtful whether it will find wide use for ordinary manual welding installations.

The main objections to the system are the extra expense of special equipment and the extra copper required to distribute heavy current and to prevent interference between arcs. In addition, an installation of this kind, like the d.c. multiple-operator system, is not nearly so flexible as one made up of individual single-operator arc welding transformers. The only apparent advantage of the system is the absence of 220 or 440 volt primary power leads on the welding floor. But with equivalent permanent installations of stationary units, no portable primary cables are needed with single-operator sets either.

It is sometimes thought that the use of a three-phase transformer will balance the single phase of the welding arc between the three phases of power supply. This is not the case, however, unless the arcs themselves are balanced on three phases of a three-phase low voltage distribution system, because a three-phase transformer will draw single-phase power from the primary when single-phase power is drawn from its secondary. Where a sufficiently large number of arcs are in operation to permit balancing the load on three phases of the secondary distribution system, then the same results can be accomplished with single-operator welders merely by connecting them to the three phases in approximately equal numbers.

Another impression is that the one, big distribution transformer affords a reservoir of power for the welders. This is no more true than it is of a single-operator welder installation, where the power company's transformer equipment feeds the various arc-welding transformers. In the multiple-operator, as in the single-operator system, when no power is being drawn by the arc, little power is drawn from the primary power circuit, and when peaks of load occur on the secondary, they occur on the primary as well.

Instead of eliminating interference between arcs, as is sometimes believed, the distribution of welding energy at low voltage actually increases the interference over that which occurs with single-operator equipment. It can be reduced by using sufficiently heavy copper, but it will take about 25 times as much copper to distribute a given amount of power with a 1 per cent voltage drop in the case of 80 volt distribution as it would in the case of 440 volt distribution. If this amount of copper is not provided, then interference between the arcs may be expected and the efficiency of the installation will be decreased compared with what could be obtained with the highly efficient distribution obtained with normal distribution voltages.

The feasibility of the multiple-operator d.c. constant-potential system in comparison with single-operator sets does not provide a reliable indication in comparing a.c. systems. Reactance as well as resistance must be considered in calculating distribution copper requirements, and there is little saving in no-load power loss because of the inherently low idling power consumed by a.c. single-operator units.

High-Frequency Arc Welders

The principle of the frequency changer welding set is similar to that used in sets for supplying power to high-speed portable electric tools. Standard frequency power is applied to one winding of a "rotating transformer" similar in construction to a wound rotor induction motor. While the unit is at rest, voltage of the same frequency is induced in the other winding, as in a normal transformer. In order to increase the frequency of the power from the secondary, one winding is rotated with respect to the other.

The resulting frequency is determined by the number of electrical poles for which the machine is wound, and the speed of rotation. Since the major part of the power taken from the secondary winding is transferred to it by transformer action directly from the primary winding, the power needed to rotate one winding is low, and requires only a small motor compared

FIG. 13—Fillet welds on the assembly of a 7-ton rotating field spider show the excellent appearance characteristic of a.c. arc welding. These joints are typical of those where a.c. is particularly desirable because the absence of troublesome magnetic blow permits full penetration into corners.

with those used on d.c. motor-generator sets of similar rating.

Owing to the fact that the frequency changer welder supplies a low power-factor load and takes most of its power direct from the power lines and not through the driving motor, its overall power factor is inherently low, and in this respect it is similar to the ordinary static transformer without power factor correction. Fig. 14 is an elementary diagram showing the basic scheme of connections employed in induction frequency changer sets.

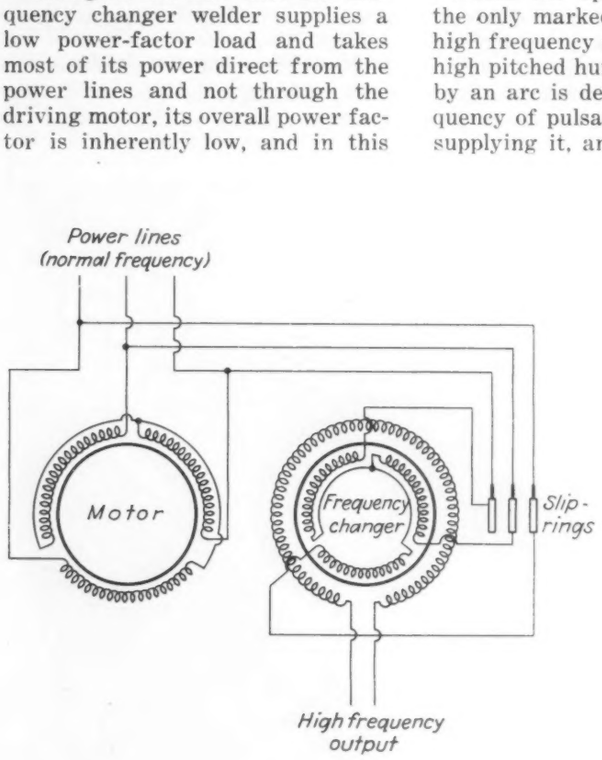


FIG. 14—Schematic diagram of induction frequency changer.

The higher frequency of the current delivered by such units produces an arc which is theoretically more stable than one maintained by 60 cycle power. That is, it is more difficult to extinguish the arc, owing to the shorter period of zero heat input to the arc (while the a.c. wave is passing through zero when reversing its direction).

While this difference between high and low frequency arc circuits becomes noticeable at low arc currents or with electrodes which have arcs inherently unstable on alternating current, the point is of general interest rather than practical value at the present time. The rapid advances in the design of electrodes for alternating current have made available electrodes which are adequately stabilized to operate with ease on normal frequencies at normal open-circuit voltages (65 to 85 volts). Such electrodes should always be used for a.c. work, and with them no improvement in operation can be expected from an increase in frequency at normal welding heats.

From the operating standpoint, the only marked peculiarity of the high frequency arc is its distinctive high pitched hum. The note emitted by an arc is dependent on the frequency of pulsations in the current supplying it, and just as a rapidly revolving siren makes a higher pitched note than a slowly turning one, so the sound of the high frequency arc is high pitched and may seem more penetrating. The arc action as regards penetration and melting rate is no different from that which is obtained with normal 60-cycle power, since the amounts of heat liberated at each end of the arc are equal in any a.c. welding, of either high or low frequency.

In operating high-frequency units, the unusually large effect of lead length and position in changing current output should be kept in mind. In the same leads, the inductive voltage drop in a set of welding leads operating at 300 cycles will be five times what it would be at 60 cycles. While this may be compensated for at the lower currents by increasing the setting of the current control, it is obvious that a point will be reached, with the unit set for maximum current, when the reactance of the leads will determine the amount of current which can be drawn by the operator. It is desirable, therefore, to keep lead lengths short when currents at or near the rating of the unit are being used.

Pilot Spark Equipment

A type of equipment sometimes confused with high frequency sources of welding power is the normal frequency welding transformer with super-imposed high-frequency stabilizing voltage. While at one time this type of equipment was recommended for a.c. welding with small electrodes and low current, its application has been virtually discontinued. One of the main objections to the equipment is the radio interference produced, because the stabilizing voltage is induced at very high frequencies in the range of radio frequencies. Moreover, the development of a.c. electrodes of inherently good arc stability and the development of special d.c. welders for very low-current work, have made unnecessary the high frequency stabilized circuit with its complication and maintenance.

Reactors on Power Circuits

Ordinary reactors have been used for a.c. welding, connected to a standard power circuit (Fig. 15) and serving as a means for controlling the welding current. This circuit is similar to the simple series ballasting resistor which may be used on d.c. power circuits to prevent dangerous short circuit currents and excessive arc currents. Like the simple resistor, the reactor has the objections of excessive current drain from the power line, and hazard of electrical shock.

With the circuit of Fig. 11, the current drawn from the power line will be the same as the welding current, and with the amperages

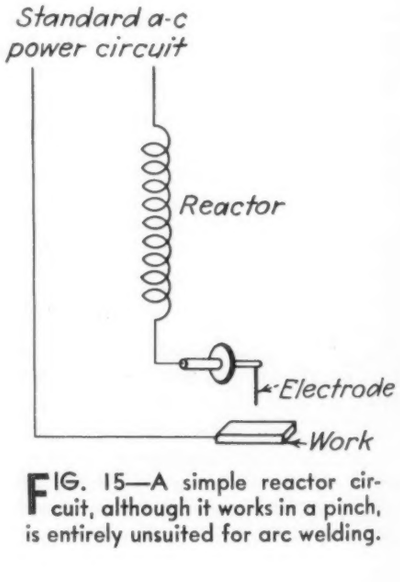


FIG. 15—A simple reactor circuit, although it works in a pinch, is entirely unsuited for arc welding.

ordinarily used in arc welding, would result in excessive cost of the distribution circuit copper, fuses, switches, and conduit. Moreover, this circuit produces a load of excessively low power factor. Operating from a 115-volt shop circuit, for example, a 25 volt arc (normal for a typical a.c. electrode) would result in a power factor of only 22 per cent.

The other objection to the use of simple series reactors, that of electrical shock hazard, is serious enough so that regardless of economic considerations, this circuit should not be recommended. From the operator's point of view, the safety hazard is the one feature of interest in this circuit. Welders should under no circumstances rig up reactors on shop power circuits, even as a stop-gap. None of these comments, however, applies to constant-potential, multiple-operator a.c. welding circuits, where open-circuit voltages well below 100 volts are used.

Appendix

Method of Calculating KVA and Power Factor of A.C. Welding Loads

In calculating the kva. drain of arc welding transformers, the losses of the units may be neglected where convenient. This simplifies the calculations and gives sufficient accuracy for all practical purposes, particularly in view of the fact that several of the factors involved in other calculations must be estimated.

Calculations may be made either algebraically or vectorially. Both methods are illustrated below.

Units Without Power Factor Correction

For this calculation, assume 10 welders, each having an open circuit voltage of 80 volts and efficiency of 80 per cent, operating on a 200 amp., 30 volt welding load with 40 per cent duty factor.

1. Kw. per unit is approximately the product of welding current and arc voltage, divided by the efficiency and by 1000.

Example:

$$\text{Kw.} = \frac{200 \text{ amp.} \times 30 \text{ volts}}{1000 \times 0.80} = 7.5 \text{ kw.}$$

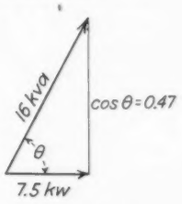
2. Kva. per unit is approximately the product of the welding current and open circuit voltage, divided by 1000.

Example:

$$\text{Kva.} = \frac{200 \text{ amp.} \times 80 \text{ volts}}{1000} = 16 \text{ kva.}$$

3. Power-factor of each unit is approximately the ratio of kw. to kva.

Example:



$$\text{P-f} = \frac{7.5 \text{ kw.}}{16 \text{ kva.}} = 0.47, \text{ or 47 per cent}$$

4. Total average kva. load is approximately the product of kva. per unit, number of units, and the duty factor (ratio of arc time to total operating time.)

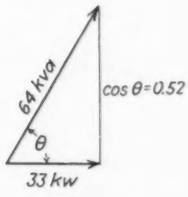
Example: 16 kva. × 10 units × 0.4 d.f. = 64 kva.

5. Total average kw. load is approximately the product of kw. per unit, number of units, and the duty factor, plus the no-load losses of the remaining units.

Example: 7.5 kw. × 10 units × 0.4 d.f. + 0.5 kw. × 10 units × (1 −0.4) = 33 kw.

6. Overall power-factor is the ratio of total average kw. to total average kva.

Example:



$$\text{P-f} = \frac{33 \text{ kw.}}{64 \text{ kva.}} = 0.52, \text{ or 52 per cent}$$

Units With Power Factor Correction

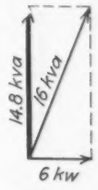
In calculating the power factor and kva. drain of units with power-factor correction, the lagging (reactive) kva. required by the transformer itself is offset by the leading (capacity) kva. of the capacitors, to a degree dependent on the welding load conditions. The kva. per unit is the vector sum of the load kw. and the net reactive or capacity kva.

The total average kva. and overall power factor of a number of units are also largely affected by the duty factor, which applies to the kw. and the reactive kva. in the calculations, but not to the capacity kva., since the latter is drawn all the time the unit is energized, regardless of whether it is loaded or not.

In the sample calculations below, it is assumed that 10 welders having an open circuit voltage of 80 volts and an efficiency of 80 per cent, with 10 kva. each in capacitors for power factor correction, are operated on welding loads averaging 200 amp. at 30 volts, with a duty factor of 0.4.

7. Reactive kva. required by the transformer itself is the square root of the difference of the squares of arc kw. and the kva. determined as in (2) above.

Example:

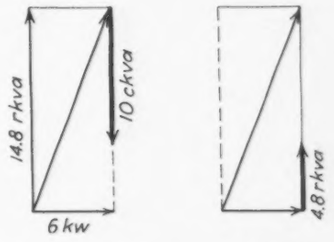


$$\text{Arc kw.} = \frac{200 \text{ amp.} \times 30 \text{ volts}}{1000} = 6 \text{ kw.}$$

$$\text{Rkva.} = \sqrt{(16 \text{ kva.})^2 - (6 \text{ kw.})^2} = 14.8 \text{ rkva.}$$

8. Net rkva is the difference between the reactive kva. just found and the leading (capacity) kva. of the capacitors (assumed to be 10 ckva. per unit).

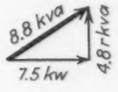
Example:



Net rkva. = 14.8 rkva. −10 ckva.
= 4.8 rkva. per unit

9. Kva. per unit is the square root of the sum of the squares of the kw. found in (1) and the net rkva. found in (8).

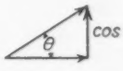
Example:



$$\text{Kva.} = \sqrt{(7.5 \text{ kw.})^2 + (4.8 \text{ rkva.})^2} = 8.8 \text{ kva.}$$

10. Power-factor per loaded unit is the ratio of the input kw. found in (1) to the kva. found in (9).

Example:



$$\text{P-f} = \frac{7.5 \text{ kw.}}{8.8 \text{ kva.}} = 0.85, \text{ or 85 per cent}$$

11. Total average kw. load of a number of units is the sum of the input kw. of the loaded units and the no-load losses of the remaining units, found as in (5).

Example:

7.5 kw. × 10 units × 0.4 d.f.
+ 0.5 kw. × 10 units × (1 − 0.4)
= 33 kw.

12. Total average reactive kva. or capacity kva. of a number of units is the difference between the total amount of capacity kva. connected (product of capacity kva. per unit and the number of units) and the total reactive kva. of the transformers alone (rkva of formula 7

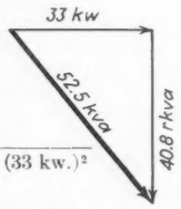
multiplied by number of units and the duty factor).

Example: Average rkva.

= (10 ckva. × 10 units)
− (14.8 rkva. × 10 units × 0.4)
= 100 ckva. − 59.2 rkva.
= 40.8 ckva.

13. Total average kva. is the square root of the sum of the squares of the total average kw. of (11) and the total average rkva. of (12).

Example:



Total average kva.

$$= \sqrt{(40.8 \text{ kva.})^2 + (33 \text{ kw.})^2}$$
$$= 52.5 \text{ kva.}$$

14. Average overall power factor of a number of units is the ratio of average kw. of (11) to average kva. of (13).

Example:

$$\text{P-f} = \frac{33 \text{ kw.}}{52.5 \text{ kva.}} = 0.63, \text{ or } 63 \text{ per cent}$$

NOTE: This average power factor will be *leading* because the total capacity kva. exceeds the total reactive kva. of the transformers which are loaded at one time, calculated in (12) above.

Correction of Other Plant Power Factor

The foregoing calculations give the kva. and power factor figures for the transformer welding load alone. When welders with power factor correction are operated at the same time as other plant load, they often will help to correct the plant power factor. In the sample calculations below, it is assumed that a load of 100 kw. at 0.8 p.f. lagging is operating at the same time as the welders.

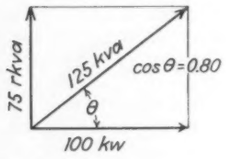
15. Other plant kva. will be the kw. load divided by its power factor.

Example: $\text{Kva.} = \frac{100 \text{ kw.}}{0.8} = 125 \text{ kva.}$

16. Other plant rkva. is the square root of the difference of the squares of the kva. and the kw.

Example:

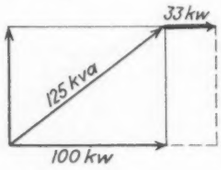
$$\text{Rkva.} = \sqrt{(125 \text{ kva.})^2 - (100 \text{ kw.})^2}$$



= 75 rkva.

17. Total kw. of plant and welders will be the sum of the kw. of other plant and the welders (11).

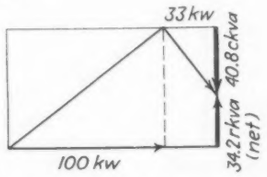
Example:



Total kw.
= 100 + 33
= 133 kw.

18. Total rkva. of plant and welders will be the algebraic sum of the rkva. of other plant (16) and the ckva. of the welders (12).

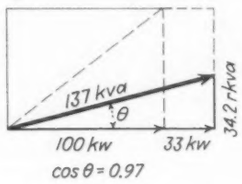
Example:



Total rkva. = 75 rkva. − 40.8 ckva.
= 34.2 rkva.

19. Total plant and welder kva. is the square root of the sum of the squares of kw. (17) and rkva. (18).

Example:



$$\text{Kva.} = \sqrt{(133 \text{ kw.})^2 + (34.2 \text{ rkva.})^2}$$
$$= 137 \text{ kva.}$$

20. Total plant and welder average power factor is the ratio of kw. (17) to kva. (19).

Example:

$$\text{P-f} = \frac{133}{137} = 0.97, \text{ or } 97 \text{ per cent}$$

All the calculations above involving duty factor give results which are obviously average figures over a reasonable period of time, such as 10 min. Instantaneous values of kw., kva., and power factor will differ from the average figures depending on how many units happen to be operating at the same time. How much these differences will amount to is a function of the diversity of the load, and consequently will be small when a large number of units is involved. Where experience with a given shop indicates that the load diversity is not sufficient to prevent occasional sustained peaks of power consumption, provision for them should be made in selecting feeder circuit equipment. Even in such plants, maximum demand meters will usually reflect virtually the average values obtained above, because they register over periods of 15 or 30 min.

Ingot Surface and Mold Washes

THE experienced gained at the Elektrostal Works with a number of ingot mold washes is briefly summarized, in Russian, in a recent issue of *Stal*. Varnish, with 25 per cent aluminum powder, tended to contain moisture but was found satisfactory for certain types of steels, while petroleum pitch, with 25 per cent aluminum powder, was most suitable when applied uniformly as a thin coating to hot molds.

A mixture of "lakol" and resin, 10 and 40 per cent, with the addition of 25 per cent soot was suitable for 9 ton ingots when applied to molds at 194 to 248 deg. F. Molasses with the addition of 25 per cent aluminum powder was suitable for high alloy and high speed steel ingots, but to eliminate moisture, the coating must be applied to the molds at 302 to 482 deg. F. Other data on the consumption of wash for molds of different sizes and figures characterizing the effect of washes on the ingot surface are also given.

Synthetic for Steel Protection

THE problem of the replacement of zinc coating during the national emergency by other efficient means of corrosion protection for metals has been investigated by the Roxalin Flexible Lacquer Co., Elizabeth, N. J., which has developed "Roxaprene," a synthetic which is claimed to have excellent corrosion resistance as compared with galvanized metal. It is found that "immersed in a 2 per cent caustic solution Roxaprene coated steel is unaffected at the end of 600 hr. Also, the new material showed signs of failure only after 96 hr. in a dilute hydrochloric acid solution."

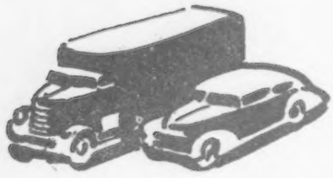
Since Roxaprene is applied like other paint finishes, by spray dip or roller coat, it requires no special equipment. It air dries easily, or may be forced dried very quickly. The new product is already being used successfully by manufacturers of air conditioning equipment, motor trucks, bottle caps, fans, blowers, pumps and special machinery.

KEEPING "BUGS" OUT OF BRASS. In the making of brass and other copper-base alloys, Revere adds a vital ingredient—the *human touch*—that has a way of producing better metals. Behind each operation is a trio like Arthur Bower, Harry Schagrin and Alfred Roy, which combines the experience of a foreman, the knowledge of an engineer, and the skill of an able craftsman. Methods, supervision, operation, each is in very capable hands. It is such teams as these that keep "bugs" out of Revere metals . . . making them *right* for the needs of Defense today, and preparing well for the new needs of tomorrow's revived industry. Revere Copper and Brass Incorporated, 230 Park Avenue, New York.

★ ★

Assembly Line . . .

• Defense production slowly pushing "strictly automotive" facilities aside . . . Fifth of Chevrolet Buffalo plant found convertible for airplane engine production . . . Car production declines again.



DETROIT—A consolidation of the automotive industry's "strictly-automotive" facilities is in order, now that major plans for defense have reasonably well jelled. This will take the form of an increasing retrenchment, in terms of floor space and equipment, as defense production becomes a greater portion of the industry's total output.

A first step like this was made a short while ago when Chevrolet began clearing out its Tonawanda (Buffalo) engine and axle plant, to turn it over to production of airplane engines. This plant is only a few years old, and had much equipment that was more modern than the equipment used in the Flint engine plant and the Detroit Gear and Axle division. Some of the special equipment was moved to Flint or Detroit, some has been converted for airplane engine manufacture, and the rest has been shoved to one side.

(Incidentally, as a weather-vane in the argument about the percentage of automotive equipment that can be used for airplane engine work, a checkup shows that only 25-30 per cent of the Chevrolet equipment was convertible, although the management had every conceivable reason for desiring to go the limit, since return of the eastern plant to automobile work is at least a doubtful future prospect. Some of the machines were rebuilt to adapt them to the aircraft work, all the rest had to be retooled before they could be used.)

OTHER retrenching is going on now in the old Highland Park plant of Ford Motor Co. Tank parts will be made there, and bomb sights. Because of this, Ford started to move some minor operations to one of the small rural plants outside Detroit; in order to avoid displacing women workers from their Highland Park jobs, this move has been delayed until the defense work in the plant is near a start. Then the workers can be transferred to the defense jobs. However, several small concerns which have been occupying rented space at Highland Park are to move soon. Briggs also will vacate its space in the Highland Park plant, but maybe not until early in 1943.

Briggs probably will make some other sweeping changes in its various plants around Detroit, to retrench its automotive work and to make room for further defense work.

Major changes also impend in the Chrysler set-up. Two of the most important plants, Plymouth and De Soto, will be cleared of automotive operations, so they can be concentrated on defense work. Plymouth's factory is the world's largest auto assembly plant, but it will be devoted mostly to gun manufacture. Output of Plymouth cars will be concentrated at the Dodge plant, a basic similarity in the two cars facilitating this. De Soto will be moved to the Chrysler-Jefferson plant, where De Soto engines are now built anyhow. Here again, basic similarity of the Chrysler cars and the De Sotos will help out. The De Soto buildings will be devoted to gun manufacture and airplane fabrication.

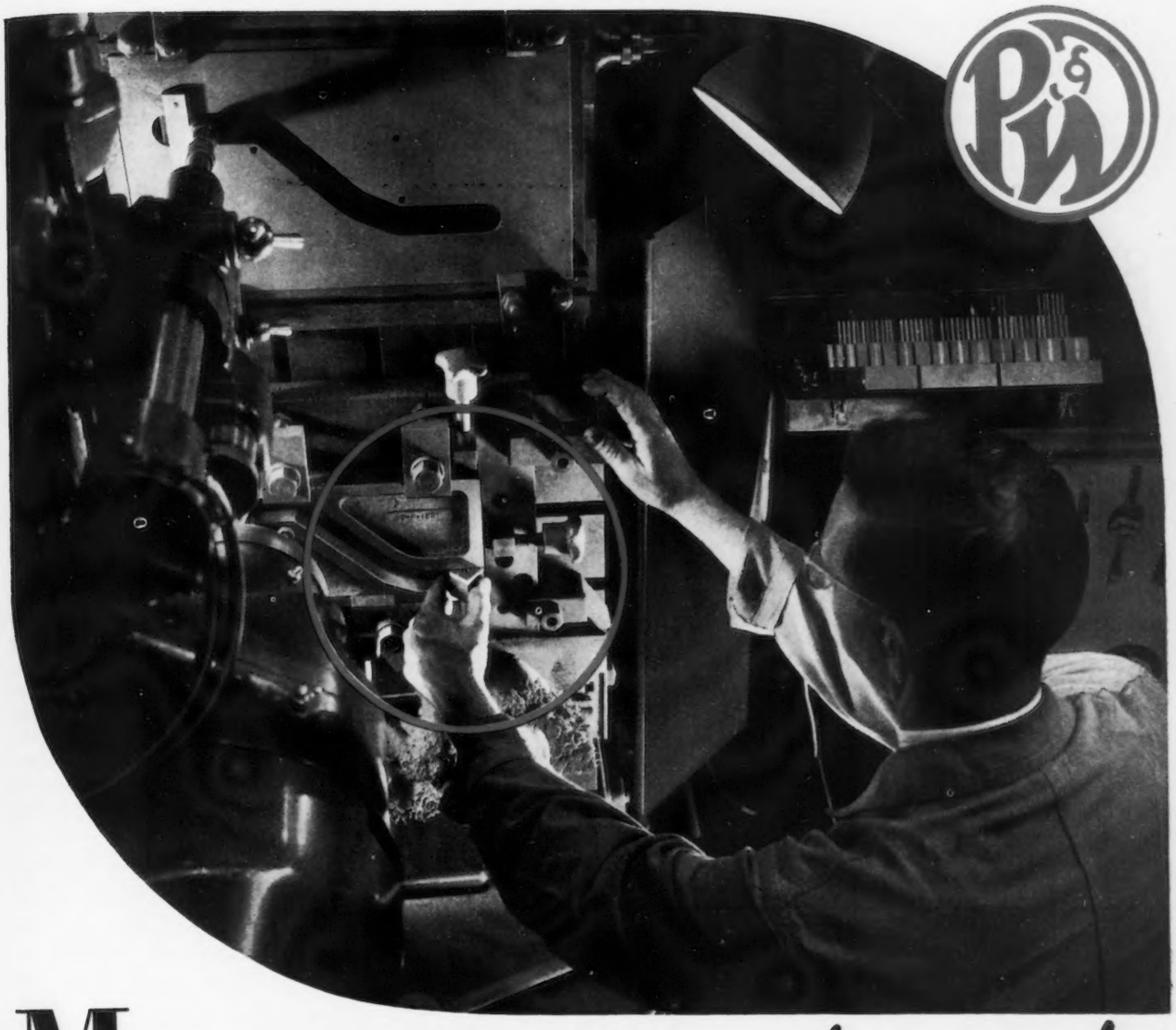
TRIMMING of automobile output goes on, with the assemblies for last week totaling only 90,205 units, compared with 93,495 in the previous week and 130,040 cars and trucks in the corresponding period of last year, according to Ward's Reports, Inc.

The mass production of metallic machine gun belt links has been begun by National Stamping Co. in a new Detroit plant. The metal links take the place of the older web ammunition belt, familiar in World War I. The links are designed to eliminate many of the gun stoppages which previously occurred. Because the stampings are held to close tolerances, the manufacturing is considered quite specialized. The tolerances are held close so 30 and 50 caliber shells which form the hinges between the links will not drop out or be too tight for ready loading. Progressive dies of complicated design are required to punch and form the links.

National Stamping probably set some kind of a record in erecting its new building, tooling it completely, and getting into production within five months after receiving a contract. The presses in the plant have been employed until very recently in the production of automotive parts. All the workers have been transferred from automotive production, in many cases without loss of working time. The firm has arranged its equipment and plants so that work for automotive requirements can be carried on without interruption. New installations include special heat-treating equipment and rust-prevention, shot-blasting, cleaning and oiling equipment.

An interesting evaluation of defense production comes from Nicholas Dreystadt, general manager of Cadillac, who says that his plant's efficiency in the production of Allison aircraft engine parts "compares favorably with that of our automobile production, which we have been improving for almost 40 years."

The defense job has been engineered on a sound basis, he said, and Cadillac's planners did not question whether the national emergency would be long-lived or short-lived. They have set up procedures in the shop that will coordinate the thinking of the engineering department and the actions of machinists throughout the entire program. To do this, H. A. Barber, production superintendent of the Cadillac-Allison factory, adopted a technique which appears to be far better than the old one of route sheets, or operations charts. He transferred data on each manufacturing step to separate "information sketches." A staff of General



MILLIONTHS *at work!*

Here is a Keller Machine doing a special job — milling an accurate cam path. The slot width is important and you can see for yourself how this operator makes sure of it. That little stack of Hoke Precision Gage Blocks tells the story.

You can make up any dimension you want with P&W Precision Gage Blocks. Each is accurate within a few millionths of an inch so that you can wring them together in stacks as you wish, and the combined errors of the several blocks are still negligible. They are the precise standards for setting other gages or for checking actual jobs.

P&W Precision Gage Blocks are sold either singly or in sets of various convenient sizes. The 85E set is shown at the left. For complete information write to Pratt & Whitney, Division Niles-Bement-Pond Company, West Hartford, Conn.

PRATT & WHITNEY

Motors Tech students was recruited to transfer all essential data into a form which former automotive plant workers could easily and quickly assimilate as they started at the unfamiliar tasks of making airplane engine parts.

SINCE changes in specifications on airplane parts occur quite often, this method makes it possible to hand an up-to-the-minute sketch to each machinist whenever changes are made. Each sketch carries all of the information that the machine operator needs to know about his operation. The sketch fits into a holder at the machine and remains there until the operation is changed. Route sheets still exist, of course, but the information on them is of importance mostly to the supervisory staff.

Machine set-up time has been reduced, again by short circuiting the route sheets. The job setter refers to the information card given him by a production foreman and follows directions which even tell him what tools he needs in the new set-up.

Barber estimates that the Cadillac-Allison system makes use of 3500 information cards. They eliminate much of the previous lag in putting revision orders into effect, he says.

One of the noticeable features about tooling in defense plants in the automotive industry is the degree to which machine operators are relieved of the need for figuring out any of the details required. No matter what the operation, it is seldom necessary for the operator even to locate centers on a part or to determine locating points. An example seen recently is in the machining of an aircraft crankshaft. The forging reaches the production line with centers already drilled, and prick punch marks on the forging to serve as longitudinal and radial locating points. Not satisfied with this, the process engineers have started the job with two initial operations which provide flat locating spots (determined from the prick punch marks). The flat spots rest against fixed points in the fixtures on each machine thereafter so the operator cannot conceivably make any error in machining.

EXPLAINING this, an engineer said, "Our operators are all coming from the automotive division of our company, and there they have been trained to expect such conveniences as these. And, from our viewpoint, it relieves us of many worries about whether a job is being done right. The tooling assures that it will be." Of course, a multitude of inspection operations verify the accuracy of each part, too.

2,000,000 HP.: During November, Pratt & Whitney Aircraft Division of United Aircraft shipped a total of 2 million hp. in air-cooled engines, sufficient power for more than 800 twin-engine bombers. The motors on the left line of the final assembly floor are 450 hp., and those to the right are 2000 hp.

Everyone is talking about post-war economics, but so far only one industrial or engineering group, to our knowledge, has started to do anything about it. A definite, analytical investigation of port-war prospects, and of engineers' obligations in the years ahead, has been launched through the efforts of A. M. Selvey, it appears. Selvey, an engineer with Detroit Edison Co., and chairman of the Detroit section, American Society of Mechanical Engineers, broached the subject of post-war planning before the board of the Engineering Society of Detroit. This group was approached because it represents most of the organized engineering groups in the Detroit area, and has some 2500 active members engaged in the engineering profession.

Selvey suggested that there should be an investigation and interpretation of "the total-war problem, and all that goes with it, including post-war phases." He suggested that the best minds of the city and state on economics, agriculture, sociology, labor, management and government be welded into a single group to study the problem.

Speaking particularly of conditions in this industrial area, he pointed out that a billion-dollar Public Works Reserve Program is being organized for the state as a post-war measure—most of it for non-productive types of projects. Engineers, he said, should try to direct such efforts into self-sustaining types of activity.

As a result of his proposal, the Engineering Society has appointed a group of nationally known Detroit engineers to make a preliminary study. John H. Hunt, director of the new devices section, General Motors Corp., is chairman, with T. A. Boyd, head of the fuel department of GM Research; Harold Ellington, architect; Clyde Paton, chief engineer of Packard; and Harvey M. Merker, of Parke, Davis & Co., as members.

As stated, the committee is exploratory in nature and probably cannot be expected to go very far in its initial recommendations, except on the advisability of having the engineering group go farther into the subject later on. We suspect, however, that there will be a lot of interest in the results of investigations made by this group.

In the Air and in the Shop . . .

men rely upon *this* Stainless

In the air Carpenter Stainless Steel provides safety and top-notch performance, while in the shop speed and economy in production have given it a high rating on industry's *preferred* list.

Ever since the early days of Stainless, when Carpenter pioneered easy-to-work strip and free-machining bars, men have turned to this Stainless for making vital parts.

It is small wonder, then, that this outstanding Stainless of peacetime days should be called upon to play an even more important role in the drama of national defense.

All the things that have made this Stainless easier-to-work — extreme uniformity, controlled temper, gauge and physical properties—are now helping to speed defense production with fewer interruptions and a minimum of rejects.

Yes, it takes *good* Stainless to make defense equipment . . . and Carpenter is doing its utmost to catch up with the greatly increased demands for its specialty steels. In spite of the great increase in output already attained, further expansion is being pushed rapidly to meet urgent defense requirements.

THE CARPENTER STEEL COMPANY

121 W. Bern Street, Reading, Pa.

Carpenter STAINLESS STEELS

BRANCHES AT Chicago, Cleveland, Detroit, Hartford, St. Louis, Indianapolis, New York, Philadelphia

Washington . . .

• Broader allocation system means heavier load for Iron and Steel Branch of OPM... Fears are expressed that further curbing of supplies for civilian consumption will take place . . . Shake-up of defense agencies rumored but SPAB appears likely to escape much change.

WASHINGTON — With steel headed into a broader but not a total allocation system, as seen by an order formalizing this process for all plate production, a heavier load falls upon OPM's Iron and Steel Branch. This means that more and more dependence will have to be placed on those in the industry for advice in working out what probably will prove to be a difficult distribution job.

For with an "all out" allocation for plates, it is hoped that schedules can be better arranged and coordinated in order both to keep production at a peak and to more satisfactorily supply essential civilian needs after direct defense requirements are provided. But for such tight products as plates, pickings for civilian users will be scant.

Complaint has been made in the past of a lack of proper scheduling with a resultant loss of considerable tonnage that might well have gone to civilian use after supplying the four big customers—Navy, Army, Maritime Commission and Lend-Lease.

CONFERENCES with steel executives are designed to develop improved scheduling and better distribution. The latter obviously is a problem of delicacy since determination of preferred essential consumers has in it the elements of mixed opinions and even emotions that may prove difficult to overcome. As an example it is said that high if not highest on the preference list will be makers of agricultural machinery, and certainly a strong argument can be made for producers of tools that are necessary to the production of food. But so can strong argument be made for other consumers of steel, as for instance, pipe manufacturers and tank and car builders and a long list of other users.

OPM itself does not know just how the allocation system will work or how far it will be developed but it does hope that by careful planning in steel it can provide larger and more satisfactory distribution of tonnages to essential civilian users without restricting defense supplies.

TYING in with the allocation system is the new Production Requirements Plan, which OPM's Division of Priorities says, is designed to help manufacturers of products needed for defense or essential civilian use to obtain priority ratings in requirements on quarterly basis.

On the other hand, it has been conceded at OPM that the allocation system for steel may well mean even further curbing of supplies for civilian use. Many fear the latter development will take place. They point to OPM's statement that defense and civilian plate orders have been far in excess of present capacity. Capacity was placed at 600,000 tons a month, which was said to be 250,000 less than total orders on hand on Nov. 1. But the ray of light in this picture is in the conversion of strip mills to plate production. Once completed, this conversion, according to estimates in the industry, will bring the annual plate capacity to 13,000,000 tons. OPM's figure is more conservative, fixing the capacity at 12,000,000 tons.

With its Iron and Steel Branch improved for better coordination with the industry, OPM expects to provide a more adequate distribution system. Because plate allocation will set the pace for other steel products the outcome of the all-out government-directed distribution plan for that product is being watched with unusual interest.

MEANWHILE, eyes are being focused with considerable concern on the overall defense set-up as reports spread of fumbling and slowing down that, it is predicted, foretell an inevitable shake-up. On one side too much bureaucracy with confusion and conflict, unusually characteristic of the present government, is held to be fettering the defense program. On the other side, there is an absence of a clear definition of authority and responsibility all the way down the line.

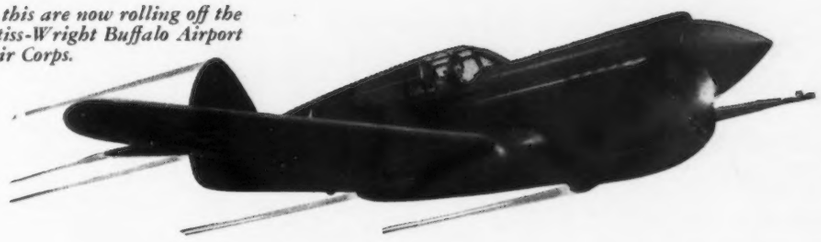
Criticism is made of OPM's methods rather than of its personalities, though that there is internal bickering appears evident. The upshot is that another reorganization is said to be in the cards, not so much within SPAB, as within OPM.

THOUGH there continues to be criticism that the whole defense organization should be directed by one man as was done in World War I, the chances are that SPAB will not be reshuffled much, if any—at least not for the present. On the contrary President Roosevelt is said to be considering orders for an even more complicated defense set-up. But despite the fact that he sits as head of SPAB, Vice President Henry Wallace is represented as being dissatisfied with its performance and to favor a completely new and more simplified organization. He is said to have checked, if he has not entirely stopped, Presidential plans for further burdening SPAB with added ornamentation. Certainly Mr. Wallace by no stretch of the imagination can be rated as an able administrator. Hence, if he is not satisfied with SPAB's job it must indeed be bad.

In any event the early reorganization of OPM is being freely predicted. For one thing it is said that it will eliminate its two-headed direction. From the outset it was widely contended that such direction was an anachronism and would not work.

Its "co-directors" are William S. Knudsen in charge of production and Sidney Hillman, in charge of the Labor Division. The forecast is that a single head will supplant the two-headed direction and that the co-director to be removed will be Mr. Hillman with his Division remaining as a part of OPM

P-40 type pursuit ships like this are now rolling off the production lines of the Curtiss-Wright Buffalo Airport Plant for the U. S. Army Air Corps.



CURTISS-WRIGHT GETS *"Better than Daylight!"*

WITH G-E MAZDA FLUORESCENT LIGHTING!

White G-E MAZDA F lamps in continuous channel RLM reflector equipment provide this low bay area in the new Curtiss-Wright Buffalo Airport Plant with approximately 30 footcandles of light. These reflectors, designed for three lamps, at present are equipped with only two. Thus a 50% increase in illumination may be effected at any time with very little additional cost.

THE Curtiss-Wright Corporation's new Buffalo Airport Plant in mass production is working 24 hours a day producing P-40 type pursuit ships for the U. S. Army Air Corps.

As shown in the above photo G-E MAZDA F (fluorescent) lamps provide "better than daylight" in this plant because this kind of light is efficient, economical, and dependable 24 hours a day.

Let General Electric show you how higher level lighting can also speed production, reduce errors, and improve morale in your plant. Your local electric service company or your G-E MAZDA lamp distributor will show you how to get the higher lighting levels you require, either with incandescent, mercury, RF, or G-E MAZDA F lamps, or a suitable combination . . . *engineered to your needs.*

G-E MAZDA *Fluorescent* LAMPS

GENERAL ELECTRIC

Requirements Plan Formally Issued

Washington

• • • **OPM's** Priorities Division last Wednesday officially announced issuance of its new Production Requirements Plan which is designed to grant priority assistance to manufacturers engaged in essential production. A copy of the form (PD-25A) for this plan was published in THE IRON AGE of Nov. 27 together with an outline of the plan.

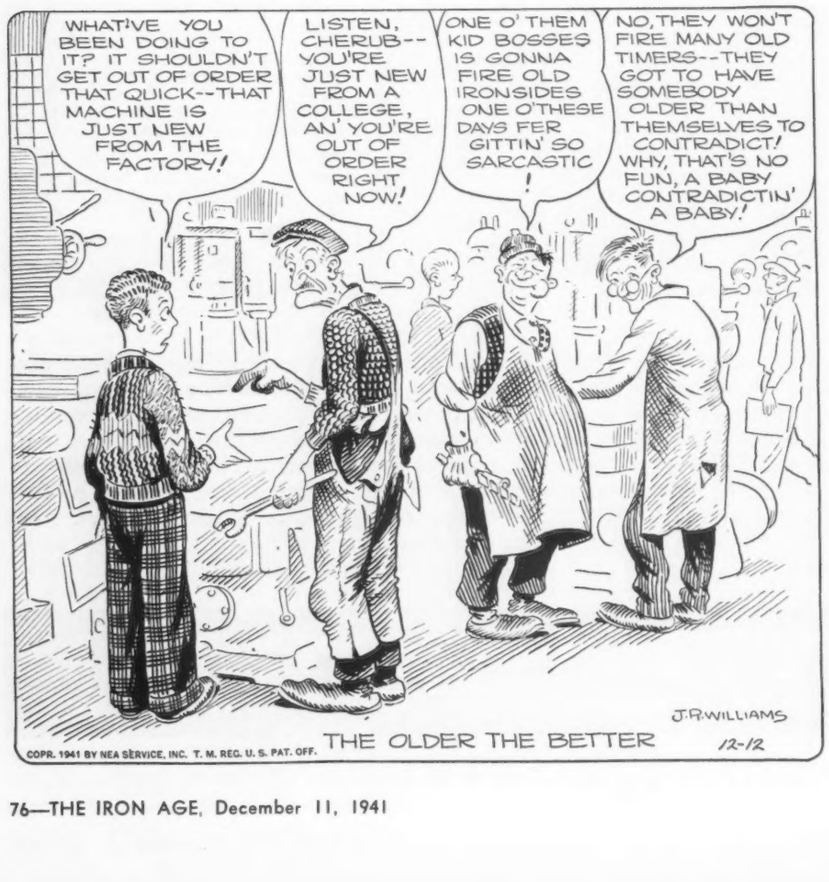
Effective for the first calendar quarter of 1942, the new procedure was adopted in order to help thousands of manufacturers of products needed for defense or essential civilian use to obtain priority ratings which will cover their materials requirements for three months at a time. For the purpose of simplification the plan provides that the number of separate applications for priority assistance will be reduced to a minimum. It is to be applied first on a company basis and it is expected to form the foundation for similar plans on an industry basis.

A list of critical materials known as materials list No. 1 is part of the plan. The preference rating granted may be used only to obtain materials on this list except when other items are specifically named in the form in a section provided for that purpose. The ratings will apply only to materials needed for defense or essential civilian production and cannot be used to obtain capital equipment. Such capital items—for example, machine tools and other production goods—must be obtained in the usual way by filling out application form PD-1, if they cannot be obtained without aid.

A manufacturer who applies for priority assistance under the Production Requirements Plan will show the type and volume of products he has been making, their use in relation to defense or essential civilian needs, the amount of scarce materials he has on hand, and the additional amounts he will require to fill his production schedule for the next calendar quarter.

In determining what priority may be granted to the applicant, the Priorities Division will take into account (1) the amount of defense or essential civilian production involved, (2) the end use of the products, (3) the materials required for production, (4) the overall policies of SPAB, and (5) the recommendations of the appropriate industrial branches of OPM. For more details see page 101E.

THE BULL OF THE WOODS — BY J. R. WILLIAMS



U.S. Plane Output At 20,000 Yearly

• • • **Col. John H. Jouett,** president of the Aeronautical Chamber of Commerce of America, told members at their annual meeting in New York on Dec. 4 that the industry already has performed "an industrial miracle"; that the industry this year is producing nearly 20,000 military planes; and that it will be called upon to put out nearly 100,000 warplanes during the next two years and that these American aircraft "will prove to be, beyond any question, the deciding factor in this war."

"The aircraft manufacturers of the United States this year are turning out several thousand more military planes than the most optimistic of government officials dared to hope for 12 months ago when they called upon the industry to speed up its output which even then was breaking all records," Col. Jouett said. He continued: "Our manufacturers are turning out nearly 20,000 military planes this year. That is more than eight times the production two years ago, in 1939. The dollar volume of more than $1½ billion in production of planes, engines and propellers in 1941 is about triple that of last year. The production rate is rising month by month. Our engine plants have now reached a monthly production rate of nearly six million horsepower, 12 times the monthly rate at the outbreak of the war in late 1939. Peak production of 15,000,000 hp. monthly will be reached in 1943. In propellers, the present rate is more than 50,000 a year."

"We are supplying the air forces of the United States, Britain and other governments with more than 30 different types of combat aircraft. They are in service on all continents and in all war zones. Their performance and reliability

in action is the subject of a steady stream of laudatory official reports flowing back here from those who use them. The vastly increased output and the fine performance make this year's achievement of our manufacturers an industrial miracle."

"This year's record, however, is only part of the story. It has been our first year of real production for defense. During the next two years our industry, its subcontractors and other companies which are preparing to produce aircraft equipment, will be called upon to deliver nearly 100,000 warplanes. You will recall that when President Roosevelt in his defense message of May 16, 1940, said that he would like to see the industry able to turn out 50,000 planes a year, it seemed a fantastic figure in view of the past, both here and abroad.

"We now have every reason to believe that an annual production rate of 50,000 planes will be reached some time next year. Moreover, all these planes will not be frozen models. Our manufacturers even now either have in the design stage or are actually experimenting with no less than 40 new models of military aircraft."

Rating Given Electrodes For Resistance Welding

Washington

• • • **OPM's** Division of Priorities last week assigned a preference rating of A-1-c to orders for materials entering into the production of resistance welding electrodes. The preference rating is applicable to the producers' requirements of specified materials for a three months' period covered by an application for priority assistance under Preference Rating Order No. P-85.

Producers of resistance welding electrodes who wish to obtain priority assistance under the order must first file an application with the Priorities Division on Form PD-82 and must receive specific authorization for use of the rating. After a producer has received the authorization he may serve certified copies upon his suppliers and thereafter use the rating by endorsement on his purchase orders. Monthly reports of all applications of the preference rating are required on Form PD-81 or PD-81a.

WEST COAST . . .

• War time emergency measures are put into effect quickly in Pacific States after Japan starts hostilities . . . Huge plane plants and shipyards are being heavily guarded . . . Shipping bottled up temporarily.

SAN FRANCISCO — Industries in the Pacific Coast States went on an emergency, war time basis abruptly over the week end. Within a few hours after Japan's treachery became known, plant protection forces were beginning to function.

The huge military airplane plants at Los Angeles and Seattle and the shipyards on Puget Sound and here on San Francisco Bay were being heavily guarded Monday against intruders from without and sabotage from within. At some of the most important government establishments blackouts were ordered. Shipping was bottled up temporarily by government order in the ports of Los Angeles and San Francisco.

The widely-heralded welders' strike, which has been the darkest cloud hanging over West Coast production, was called off speedily. Aimed at shipbuilding plants, it also threatened to disrupt operations of other industries.

Guards were posted at such important facilities as the huge Los Angeles aqueduct, bridges and power stations. Naval aircraft patrolled the coast.

Quickening of the demand for steel for further fortification of the Pacific Ocean Islands, which has accounted for orders over the past three years totaling at least 75,000 tons, is expected to follow as a result of the war.

Since August, 1939, one group of contractors alone has placed orders with Pacific Coast sales offices totaling at least 20,000 tons of structural steel and 50,000 tons of reinforcing bars for Navy work in the Pacific. This combine, headed by Hawaiian Dredging Company, Raymond Concrete Pile Co., Turner Construction Co., J. H. Pomeroy and Morrison-Knudsen has completed Navy contracts on a cost-plus basis for at least $40,000,000, and with the further association of W. A. Bechtel, Utah Construction Co., and the Byrne Organization, has just received an additional $60,000,000 award.

Full tonnages awarded have not, of course, been made public and much steel has been purchased on open contracts. Deliveries are under way on 36,000 tons of reinforcing steel allocated in September for rolling by coast mills.

These awards do not take into account substantial tonnages for Army construction on various projects in the Hawaiian Islands, chiefly for barracks and aviation facilities at Hickam and Wheeler Fields. The principal Navy demand has been for air and fleet bases. The largest tonnages have gone to Pearl Harbor, but the demand has by no means been light for Kaneoge Bay, Midway, Guam, Wake, Johnston, and Palmyra Islands. The reported loss of Wake to the Japanese, if true, means that much effort by American mills and fabricators has gone for naught. Some Army tonnage has gone to the Philippines through the U. E. Engineer.

Will this demand continue? First reaction among suppliers and contractors alike is that it must not only continue, but increase. No orders have been cancelled, so far as THE IRON AGE has been able to learn, although shipments to Wake are probably being held up temporarily.

LIKE a Mickey Mouse balloon in the advanced stages of inflation, the light metals industry on the Coast took another sudden bulge last week. Construction is under way by the Aluminum Co. of America (acting for the Defense Plant Corp.) on aluminum reduction plants at Los Angeles, Spokane, and Troutdale, Ore., up the Columbia River from Portland. Not far behind is Olin Corp.'s reduction plant at Tacoma, Wash., which has been expanded to cost $6,000,000 instead of the original $4,500,000. United Engineering & Foundry Co. of Pittsburgh has been awarded two $22,000,000 contracts for constructing aluminum rolling mills at Fairview, Ore., near the Troutdale reduction plant, and in Los Angeles adjoining the reduction plant there. Each plant will have an annual output of 60 million pounds of sheets. Also a member of the Los Angeles aluminum colony will be a $5,300,000 aluminum extrusion plant to be built and operated for the Defense Plant Corp. by Bohn Aluminum & Brass Co. In the same vicinity will be a $5,600,000 forging plant, operator not yet announced. The fabricating plants will make the Pacific Coast aircraft industry independent of the East for finished aluminum, and eliminate a trip across the continent and back for aluminum reduced on the Coast. Present Pacific Coast aluminum consumption is about 105 million pounds a year, but by the time the plants are in operation consumption will be about 150 million pounds per year. Thus, still another finishing plant is a possibility.

The aluminum plants will be tremendous power customers. Troutdale will take 97,500 kilowatts; Tacoma and Spokane, 111,000 kilowatts; Fairview, 30,000 kilowatts, and the Los Angeles plants will be the largest consumers of electric power there.

NOW, for the first time, a $3,500,000 magnesium reduction plant at Spokane, using Washington ores in the Doerner process, seems a virtual certainty. A fabricating plant in the general locality will probably be a twin to this project. About 35,000 kilowatts of Grand Coulee power will be required for the reduction plant. Meanwhile the Kaiser-owned plant in Permanente Canyon south of San Francisco is in course of expansion from 4 million to 24 million pounds annual capacity and work on the $63,000,000 plant to be operated by Basic Magnesium, Inc., near Las Vegas, Nev., is getting under way. Construction of one unit of the Nevada plant has been delayed by difficulty in securing equipment and supplies accord-

3 NEW BULLETINS ON POWDER METALLURGY

A few Durex Iron parts, made by compressing iron powders in dies, then heating under precise control of temperature and atmosphere. Many costly and time-consuming machining operations are avoided, close tolerances are maintained, vital materials are conserved, and scrap material loss is completely eliminated.

These valuable bulletins bring you straightforward engineering facts on three basic classes of products engineered by Moraine from metal powders: Durex Iron mechanical parts and bearings; Porex filters and diffusing plates; and Durex bronze oil-retaining bearings. *For designers,* they give facts on tolerances, shape and size possibilities and limitations. *For production men,* they suggest time and money-saving short cuts, show how Durex and Porex parts conserve materials, improve product performance, often do jobs never done before. *For metallurgists,* they contain helpful new information on physical properties, structures, and applications of Durex products . . . Durex Iron parts, for example, made without machining from scrap steel, replace, at low cost, parts conventionally machined from steel and iron, or die cast from such vital materials as zinc and aluminum. A request on your letterhead will bring you any or all of these bulletins without obligation.

Porex Filters: (Form 101A) *Durex Iron: (Form 102A)*
Durex Bearings: (Form 103A)

MORAINE

Pioneer in Powder Metallurgy

MORAINE PRODUCTS DIVISION, GENERAL MOTORS CORPORATION, DAYTON, OHIO

ing to the contractor. Contract for fabricating 18,000 tons of structural steel for this plant was awarded to American Bridge Co. a fortnight ago.

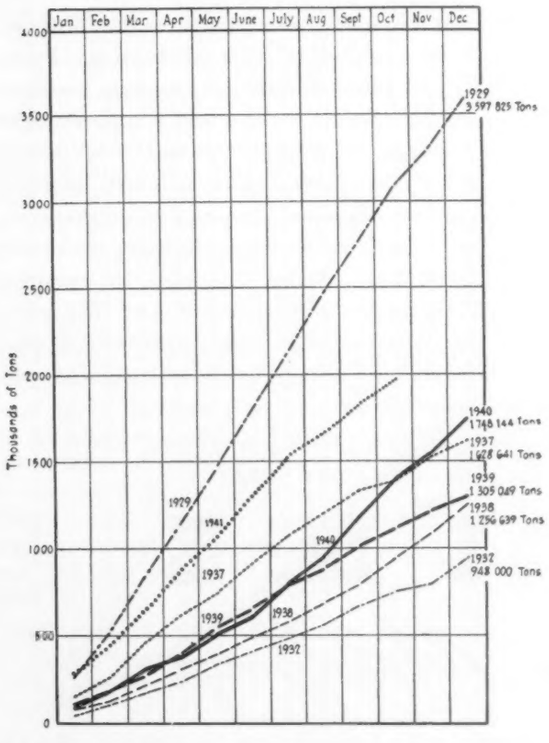
Bonneville Power Administrator Paul J. Raver, apparently launching trial balloons for additional generators at Grand Coulee, last week said that he had been asked to provide 130,000 kilowatts of power for three more defense industries in the Pacific Northwest. He said the three industries were in addition to the aluminum and magnesium plants already announced, and that two of them would be of types new in the Pacific Northwest. He said all three requests for power calls for completed plants ready to operate within 18 months. Speculation has centered around electrolytic zinc, and maganese using low-grade local ores.

Some difficulty in concluding arrangements for a new $28,000,000 copper unit at Morenci, Ariz., to be operated for the Defense Plant Corp. by Phelps Dodge Corp. adjacent to their plant there, arose last week in connection with obtaining sufficient water supply from local irrigation districts.

First complaint that transcontinental rail transportation facilities have been inadequate to the extent that they have been responsible for delay in the delivery of steel comes from the California Division of Highways. Apparently railroad facilities were inadequate for hauling heavy structural steel required for the construction of bridges and underpasses, according to the director, and although the required steel was available at the mills, the railroads could not handle it on schedule. Other delays in highway projects due to lack of steel have been traceable only to lack of sufficiently high priorities. In one case a A-1-e rating was insufficient to secure delivery of reinforcing steel for an access road to a military airport.

BRITISH competition in export territories served by the Pacific sea lanes has not disappeared but continues to be extremely keen, a Pacific Coast wire products manufacturer said last week. Deliveries to him by mills cut to 50 per cent, largely because lend-lease purchasers with higher priorities were making heavy demands, this manufacturer expressed surprise that the British were still able to make full deliveries in this export market. Always a potent factor in this particular market, the British not only have been able to fill orders, but have succeeded in continuing to give extremely keen price competition to the Americans. He expressed the hope that lend-lease demands on American mills would not increase to such an extent that lack of material would force him to withdraw altogether from the export market.

Continuation of heavy steel demands for additional Navy facilities in Hawaii and the South Pacific Islands is presaged by the award of a supplementary contract at $59,887,910 to Hawaiian Dredging Co., Raymond Concrete Pile Co., Turner Construction Co., Morrison-Knudsen Co., J. H. Pomeroy Co., W. A. Bechtel Co., Utah Construction Co., and the Byrne Organization. The first five of these firms have been working on a series of contracts of this type for the past 18 months.



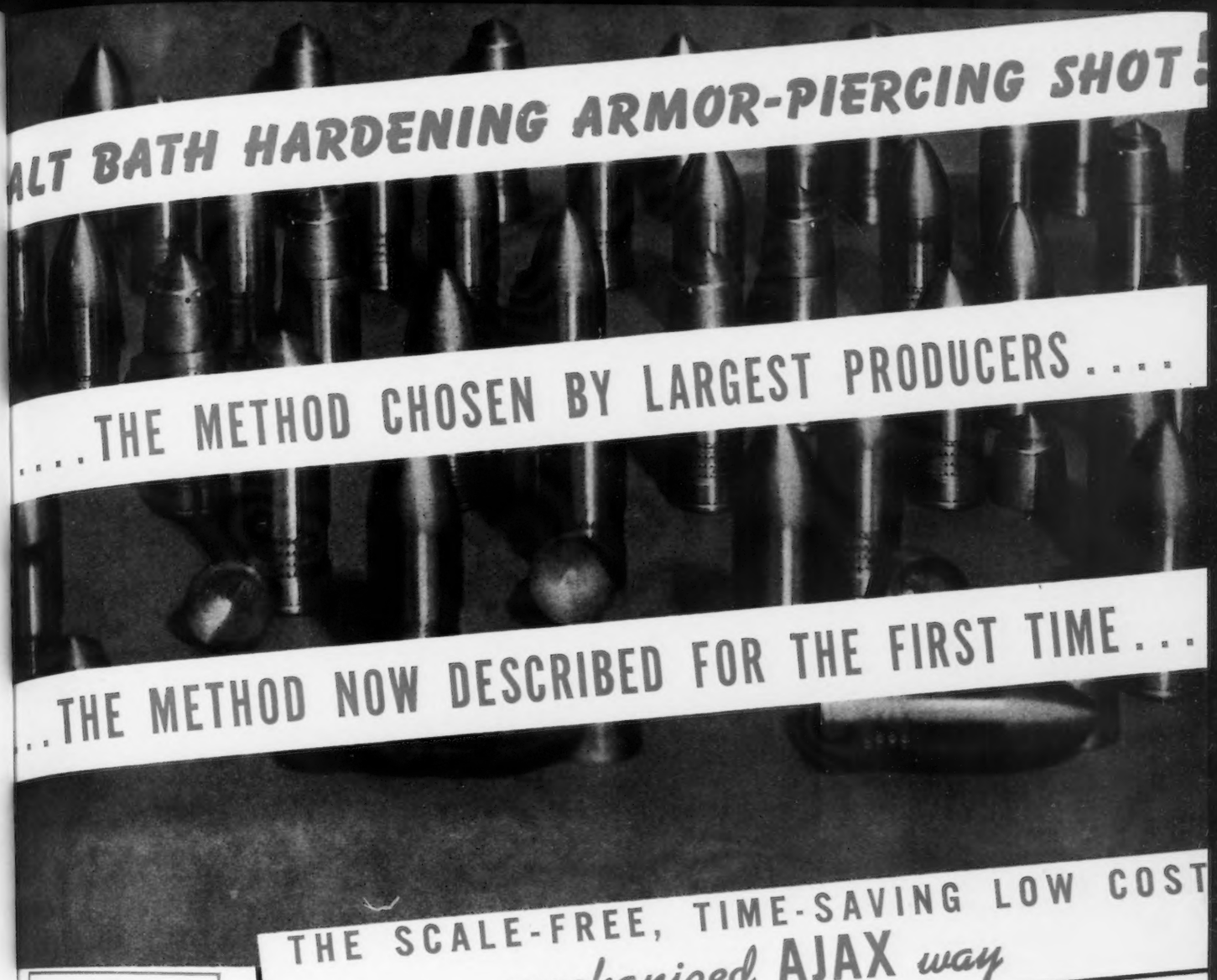
ACCUMULATIVE BOOKINGS of fabricated structural steel, according to the American Institute of Steel Construction, totaled nearly 2,000,000 tons in mid-October. It is expected by the end of the year, the bookings will reach 2,500,000 tons.

Threat to Tungsten Brings New High Speed Steel Ruling

Washington

• • • **Increased demands** for high speed tungsten steel for export, increased use of molybdenum steel generally and the threat to the Burma road, over which large supplies of tungsten now come, prompted an amendment last week to General Preference Order M-14 providing that 75 per cent of all high speed steel orders accepted in any one quarter shall be of the molybdenum type and not more than 25 per cent of the tungsten type. The previous ratio was 50-50. The amendment also extends the order until Dec. 31, 1942. It was issued June 11, 1941.

OPM pointed out that, while Western Hemisphere production of tungsten has jumped greatly since the defense program started, imports from China continue to be a vital factor in the total United States supply. It was added that the bulk of the present molybdenum supply is produced domestically.



THE SCALE-FREE, TIME-SAVING LOW COST *mechanized* AJAX *way*

HERE ARE THE KEY PROCESSES TODAY...

SIMULTANEOUS BRAZING & CARBURIZING
•
NEUTRAL HARDENING
•
CYANIDE HARDENING
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SELECTIVE HEATING
•
AGE HARDENING
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TEMPERING
•
HARDENING HIGH-SPEED STEEL TOOLS
•
ANNEALING
•
BRAZING
•
HEATING FOR FORGING

The largest U. S. producers of 3-piece 37-mm and 75-mm AP shot *specify* typical modern Ajax-Hultgren electric salt bath furnaces, equipped with in-and-out conveyors for the furnaces, oil quench, and automatic wash systems . . . and a similar Ajax installation for hardening the *caps*. Output: 600 shot per hour!

Reasons for standardizing on Ajax furnaces:

1. With solid steel shot hardened in molten salt, then quenched, washed, and drawn, the Ajax method always gives desired physical properties in both *shot* and *caps* . . .

2. Aside from inherent advantages of salt bath heat-treatment, Ajax users report that hardening, which used to take as long as two hours, is *done in one-quarter to one-sixth the time*—with no scale or decarburization, and a better core . . .

3. Such installation costs are *low*. Moreover, projectiles may be hardened selectively with ease—thus preparing for exclusive production of *one-piece* shot if called for in quantity.

Since Ajax furnaces are adopted by the largest and most experienced producers, *be sure* to get in touch with us if you plan to make armor-piercing shot. Ask for Catalog 107!

WRITE TO

AJAX ELECTRIC COMPANY, INC., 900 FRANKFORD AVE., Philadelphia, Pa.

THE AJAX HULTGREN ELECTRIC SALT BATH FURNACE

ASSOCIATE COMPANIES:

AJAX METAL COMPANY, *Non-Ferrous Ingot Metal for Foundry Use*
AJAX ELECTRIC FURNACE CORPORATION, *Ajax-Wyatt Induction Furnaces for Melting*
AJAX ELECTROTHERMIC CORPORATION, *Ajax-Northrup Induction Furnaces for Melting, Heat-Treating*

Fatigue Cracks

BY A. H. DIX

Greater Faith Hath . . .

• • • Although we had heard of checks being signed in blank and handed out with a grand "Here, write your own ticket," we always regarded them as mythical, like Santa Claus and hangover cures. But now we know that there are such things. Bob Onan of Lindberg Engineering Co. showed us one. It was from the International Book Co., Pittsburgh, and accompanied an order for Lindberg's book, "Industrial Controlled Atmospheres." The check was signed and the order read, "*Fill in our check for the net amount of this order.*"

We shall always cherish this instance of utter trustfulness, and if International Book Co. has a special checking account on which checks for say $10 or more are not honored, we hope we are never told of it.

All Work and No Pay

How would you like to buy some stock in a sure-fire money-maker? I am raising funds to start a country club machine shop. First, I get some machinery and get a government contract for some defense product. Then I install a golf links, bar, game rooms, etc., with chorus girls in short dresses for attendants. All surroundings will be beautiful, all associates polished and educated, all work easy.

The employees will be people who don't want to be drafted. When they get their notices, we certify that they are necessary for defense work. Our profits will arise from the fact that we will not pay our employees; they will pay us.

If you think I'm crazy, you're crazy.

The employer will, of course, engage inefficiency experts to conduct motion studies so that workers can learn how to get the bonuses paid for under-production.

Watch That Capital "T"

Re abbreviated style of LeTourneau's little publication, "Now," you confuse typographic abbreviations with telegraphic brevity. Typ. ab. wastes time but saves space. Greatest addicts are Dutch; it is said Dutchmen can't read ads in own papers after two or three years' absence.

Tel. brev. is old stuff in news game. An old press service man once told me, "I messaged him 'unknow story.'" He meant, "I sent him a message, 'Do not know story.'"

—*A. W. Miller*

Everyone who has tried to squeeze $4 worth into a $2 cablegram knows you can throw any verb or modifier into reverse by prefixing it with "un," sometimes with astonishing results. But cable-ese is an artificial language and has no place in our discussion.

Our investigation reveals that the bar to the adoption of time-savers is frequently a matter of preserving the dignity of the profession. A policeman, for example, never refers to another policeman as a cop; he is always an officer, and we have yet to hear one doctor call another "doc."

Around here it is as much as your job is worth to refer to an advertisement as an "ad." It is always said and written in full, to uphold, we suppose, the dignity of the craft. And although readers frequently speak of your favorite family journal affectionately as "the Age," here it is always "THE IRON AGE." Even the omission of the capitalized "THE" causes nostril twitching. So from where we sit it looks as if the paper shortage will have to be relieved some other way.

Three Strikes and a Bunt

• • • The Lehigh University band and U. S. Senator James J. ("Puddler Jim") Davis were among those heard the week before last when Bethlehem Steel's Bethlehem plant got its Navy E for Excllence. The Senator praised the music, as provided by, he said, "the Lafayette band," which was like referring to a County Cork man as coming from Belfast.

Groans warned the Senator that he erred, so he took another flier and said, "I meant the Bethlehem High School band." More groans, but louder. With two strikes on him and nothing to lose, he said desperately, "Well, then, the Bethlehem Steel band." Pronounced booing and some snickers. Someone whispered to him; he named the Lehigh band, and everyone beamed.

Bakery Engineer, Donald Nelson, and Mr. Kelly

• • • The week's contributions from our fellow-workers in the vineyard total three. Frank Oliver is moderately convulsed over the fact that the A.S.M.E. now admits there is such a thing as a bakery engineer. Our v.p. and g.m., Charles Samuel Baur, chortles over Donald Nelson's crack:

"There are always three sides to a story in Washington —your side, my side, and the truth."

And Bill Sherman sympathizes with Mrs. F.D.R. in her struggle with an adverb placement problem. The first paragraph of a recent "My Day" ended, ". . . except Mr. Kelly, who is in charge of physical education for defense, and who *apparently* functions in Philadelphia." The italics are ours. The embarrassing juxtaposition of *apparently* and *functions* is tough on Mr. Kelly, who, for all we know, is a hard-working public servant.

He Squawked About Stoppers

• • • Chet Ober of the adv. staff tells us that an adv. agcy. executive complained to him the other day about our practice of running certain headlines under the title of "Stoppers." The a.a.e.'s point is that a headline that qualifies as a stopper is not necessarily a good head.

Of course, he is absolutely right. You might be stopped by a headline that is a clever play on words, or is funny, or is high in shock value. The headline may merely succeed in calling attention to itself without arousing interest in the cause it advocates.

Therefore, our own preference is for the "line-of-duty" type of headline like these:

Tocco speed boosts hardening output 600%

How Columbium Helps Speed Fabrication of Stainless Steels

$30,000 Annual Saving . . . on Power Alone . . . with A-C Welders.

Stanostamp Gives 20 Times as Many Pieces Before This Die Needs Polishing

How you can prolong the Useful Life of the Oxy-Acetylene Apparatus you now have

. . . from 21⅛ cents each to 1⅛ cents each is the performance record of this Landmatic Head.

But once in a while you hit upon a combination of a legitimate stopper and a shock stopper that fits the situation like a sweater fits Lana. Then, like the fella in the story about the brick, you *have* something.

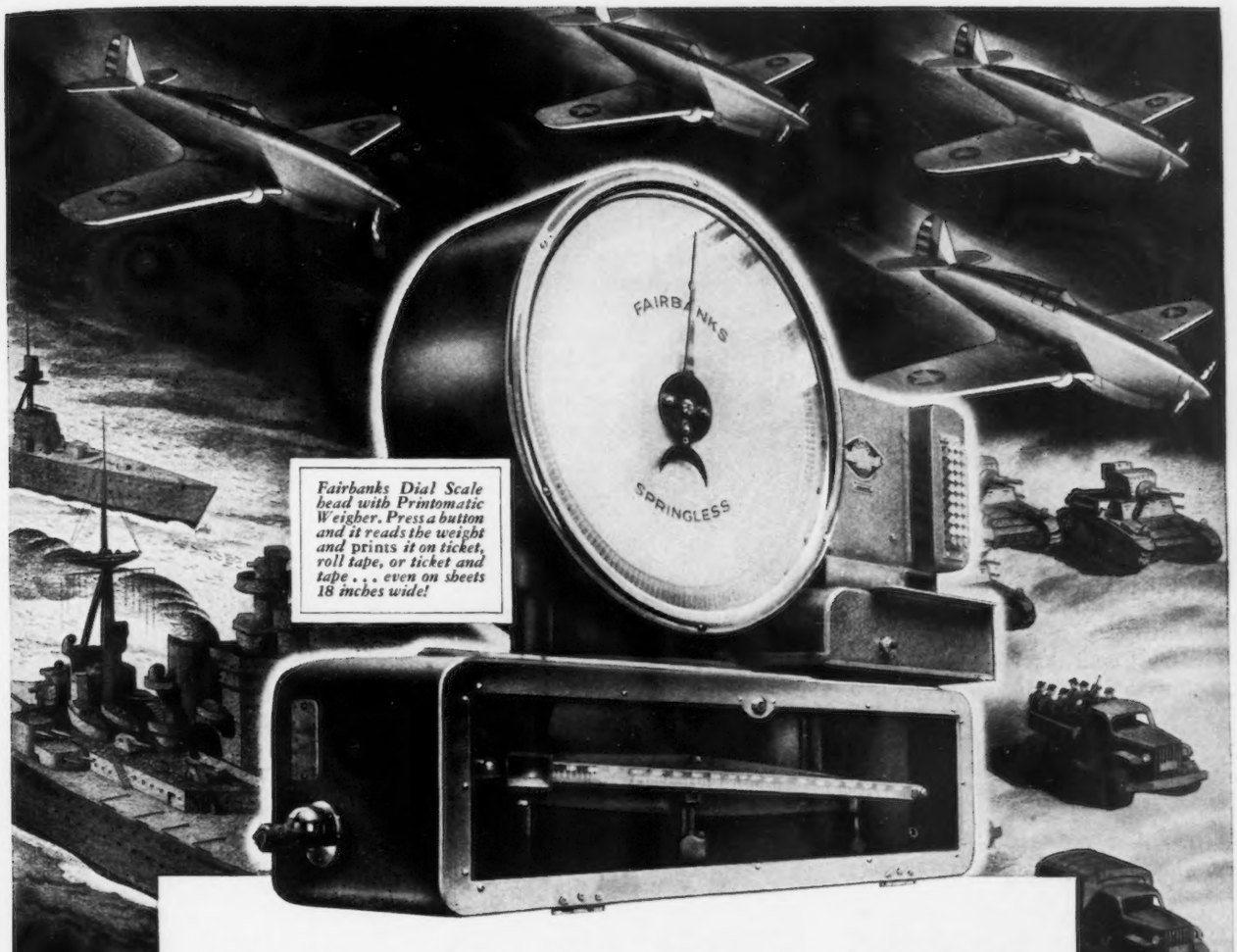
Puzzles

If Newton's Third Law of Motion is still unrepealed, A and B will reach the pier at the same time.

On Sept. 11 we printed a motor boat-swimmer problem that brought in an extra large number of answers. The majority gave the answer as 26 deg. 22 min. Two, A. W. Kelly and George F. Bottorf, insisted that 29 deg. 2 min. was correct. In our usual cautious manner, we sided with the majority, but now we find that the minority was right and we apologize. If any member of the majority wants proof that he was wrong, let him write.

The week's cerebral message is this:

Jones starts out at noon to walk from Allwood to Belleville. Smith starts at 2 P.M. to walk from Belleville to Allwood. They meet at 4:05 P.M. Each reaches his destination at exactly the same time. At what time did they arrive?



Fairbanks Dial Scale head with Printomatic Weigher. Press a button and it reads the weight and prints it on ticket, roll tape, or ticket and tape . . . even on sheets 18 inches wide!

You've Got To Work *FAST!*

● Whether you are working on defense contracts, or supplying manufacturers who are, you've got to work fast, or you . . . and your country . . . may lose!

There's no need to let slow weighing methods retard your production. For modern Fairbanks Scales are working wonders in speeding up industrial processes.

They weigh *faster*—even while materials are *on the move*. They weigh and disburse preset amounts *automatically*. They *print* records and receipts. They *count* small parts and products. And they *eliminate human errors* in reading and recording weights and in interpreting scrawled weight records.

Find out, without cost or obligation, what modern Fairbanks Scales could do for *you*. The knowledge and experience of a Fairbanks Scale Engineer are yours upon request. Write Fairbanks, Morse & Co., Dept. L-38, 600 S. Michigan Ave., Chicago, Ill. Branches and service stations throughout the United States and Canada.

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DIESEL ENGINES ELECTRICAL MACHINERY RAILROAD EQUIPMENT WASHERS-IRONERS STOKERS
PUMPS MOTORS WATER SYSTEMS FARM EQUIPMENT AIR CONDITIONERS

This Industrial Week . . .

° ° °

AMERICAN industry this week went to war with the knowledge that the almost overwhelming demand for its products here and abroad could only be met with an upsurge in production of a magnitude never before seen in the country's history.

First effect of the war declaration was to sweep away many domestic difficulties, such as strikes in war factories, and to bring a complete reappraisal of the order books and operating schedules of most big metal plants. On all sides industry was learning to substitute the word "war" for "defense".

Plant Conversion Will Be Speeded

From various industrial centers, THE IRON AGE observers reported plant managers weighing adoption of the 7-day week, the dropping in some cases of all orders except those for war goods, and the conversion of still more non-defense industrial capacity to war needs.

War has already sharpened the drive to spread defense work among small metal-working plants so that the plants themselves can be saved and so that production of planes, guns, ships, tanks and other fighting equipment can be brought to victory levels.

Clear Track Given Output for War

Without waiting for official requests from the government, the steel industry, for example, at midweek was already gearing for activity never before seen against obstacles which include serious shortages of such raw materials as scrap and pig iron. While defense orders have consistently been given the right of way in recent months, all companies this week were checking their order books and rolling mill schedules to balance output so that war materials may be produced in the greatest volume with the greatest efficiency and speed.

In the steel producing and consuming industries, demands which were believed impossible of fulfillment a month ago are now being reconsidered with the realistic acknowledgment that the nation is at war.

Machine tool manufacturers said this week that the "new sense of urgency" might establish still higher production records in that war-stimulated industry.

Battles Endanger Pacific Ship Lanes

While early reverses for the U. S. in Japan's attack without warning on Hawaii and other Pacific islands alarmed the public, industry was soberly weighing the significance of this danger to the Pacific lanes by which tin, chromium, tungsten, rubber and other vital materials are brought to U. S. industry. Most important of the Pacific metal imports and one of the hardest to replace is tin, of which the U. S. is declared to have one year's supply.

Japan's threat to the Burma Road down which the bulk of U. S. tungsten winds its way, had long been expected. The Office for Emergency Management hastened to declare that the nation is prepared with substantial stockpiles of material from the Far East. Priorities Director Donald M. Nelson again appealed for conservation of critical materials.

A quick survey of supplies of every critical material endangered by Japan's act has been ordered by W. L. Batt, head of OPM's materials division. Figures being gathered include steel.

At Washington, Blackwell Smith, assistant director of priorities, announced that OPM is going to dispense with all possible detail work in connection with the obtaining of priorities ratings. He promised that steps being taken would abolish 60 per cent of the paper work.

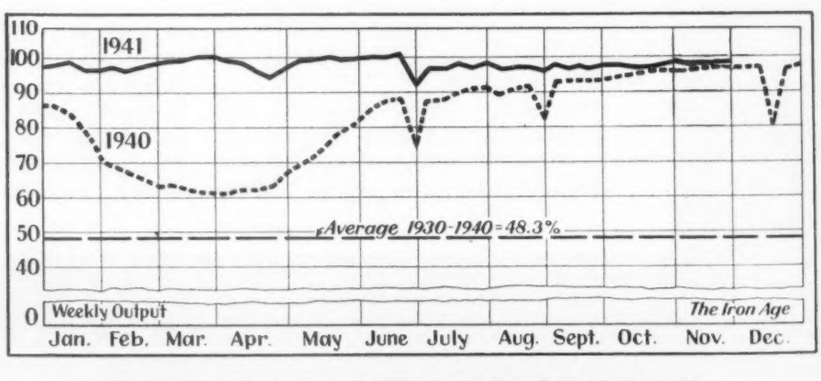
Defense officials have adopted a victory defense plan, which, it is said, will proceed at the rate of five billions a month and eventually will cost 150 billions.

New Head for OPM Iron, Steel Branch

In the steel industry, events at the week's start moved quickly. To head the OPM's iron and steel branch in new efforts to speed production and bring about better distribution, the OPM appointed C. Edward Adams, 60-year-old chairman of Air Reduction Co., and a director of the Vanadium Corp. of America and other companies. Mr. Adams, whose appointment was announced shortly after the U. S. had

Steel Ingot Production—Per Cent of Capacity

(Open Hearth, Bessemer and Electric Ingots)



Steel Ingot Production, by Districts—Per Cent of Capacity

	Pitts-burgh	Chi-cago	Youngs-town	Phila-delphia	Cleve-land	Buf-falo	Wheel-ing	De-troit	South-ern	S.Ohio River	West-ern	St. Louis	East-ern	Aggre-gate
Current Week.....	99.0	101.5	98.0	90.5	98.0	92.5	93.0	104.0	95.5	103.5	97.0	108.0	102.0	97 5
Previous Week....	99.0	100.0	96.0	90.5	96.0	90.0	93.0	105.0	95.5	100.0	97.0	102.0	100.0	97.0

declared war on Japan, was senior administrative assistant to Edward R. Stettinius, Jr., when the latter was OPM priorities director. Adams also served as special consultant to the industrial materials division of the old National Defense Advisory Commission and was once a division administrator of NRA.

Assisting Mr. Adams will be a strong staff of consultants including highly placed steel executives who are to be called to Washington in an effort to streamline steel distribution.

Steel Allocation Board Considered

Unofficially it was understood at midweek that among the steel executives mentioned in connection with the new special steel allocation committee are J. H. McKown, U. S. Steel Corp. of Delaware (possibly as chairman); M. W. Cole, Bethlehem Steel Co., consultant on plates and shapes; Norman W. Foy, alloy steels; William G. Hume, Pittsburgh Steel Co., rods, wire, wire products and cold finished steel; Arthur A. Wagner, Jones & Laughlin Steel Corp., semi-finished steel, and George G. Gries, Great Lakes Steel Corp., hot rolled bars. It is understood that Daniel F. Lacy will join the steel committee as consultant on pipe, L. F. Miller, sheet and strip, and G. F. Hocker, steel castings.

The proposed committee of experienced steel men is expected to help answer the various questions of priorities and allocations on steel products to coordinate the distribution of this metal.

'42 Scrap Shortage 10 Million Tons

Meanwhile, a survey just completed by THE IRON AGE, in cooperation with steel and scrap experts, indicates that with an impending shortage of iron and steel scrap of close to 10 million tons for 1942 and an insufficient supply of this material for 1943 and 1944, government plans to expand steelmaking capacity may merely result in idle capacity.

The immediate problem of the scrap shortage was being examined today (Dec. 11) at a Washington meeting of OPM representatives with scrap buyers and sellers. During this and recent meetings conversation centered around simplification of grades rather than prices.

NEW STEEL BRANCH HEAD: C. Edward Adams (above), chairman of Air Reduction Co., a director of Vanadium Corp. of America and various other companies, this week was appointed chief of OPM's Iron and Steel Branch, succeeding A. D. Whiteside, resigned.

Another mile post in industry's war effort was passed on Monday when the Army received from Baldwin Locomotive Works the first heavy tank (57 tons) made by an industrial plant in this country. This land battleship, carrying the heaviest armor plate ever placed on a U. S. tank, shows designers are profiting by experience gained on European and North African battlefields. Noteworthy among features of the new giant are the mounting of a full-sized 75 mm. cannon in a full revolving turret and an armor skirt to protect the suspension units. Addition of this heavy tank increases the ranges available to the Army to three: light, medium and heavy.

As industry entered a new phase of the new world war production race, steel ingot output rose a half point to 97½ per cent from 97 per cent a week ago, a level still a half point above the November peak. The increase resulted from an edging upward of schedules in most major districts.

The Pittsburgh district steel operating rate at midweek was at 99 per cent, unchanged from a week ago, Chicago was up 1½ points to 101½, Cleveland and Youngstown up two points to 98, Buffalo up 2½ to 92½, South Ohio River up 3½ to 103½, St. Louis 6 points higher at 108, and the Eastern area up 2 points to 102 per cent. Detroit eased a point to 104 while Philadelphia was unchanged at 90½, Wheeling at 93, Birmingham at 95½ and the West at 97 per cent.

November Steel 6,969,987 Tons

Weekly production of steel during November was at 1,624,706 net tons of ingots and castings, only slightly less than the record of 1,634,917 tons per week achieved in October. Because of the shorter month, total steel production of 6,969,987 tons in November fell below the October record of 7,242,683 tons. A total of 6,469,107 tons of steel was produced in November, 1940. In the first 11 months of 1941, a total of 75,763,558 tons of steel was produced, 25 per cent more than output of 60,486,305 tons in the corresponding period of 1940 and 50 per cent more than production of 50,467,880 tons during the whole year of 1917, the peak in the first world war.

Fabricated structural steel awards of 16,400 tons compare with 14,450 tons last week. The largest lettings are 3360 tons at Grand Blanc, Mich., for the Fisher Body Division of General Motors Corp., 3000 tons for a 9-story building at the Boston Navy Yard and 1970 tons for three arsenal buildings at Watervliet, N. Y. New structural steel projects declined to 9950 tons from 14,650 tons a week ago.

Reinforcing steel awards of 8600 tons are slightly higher than a a week ago and include 1800 tons at Pottstown, Pa., for the Jacobs Aircraft Engine plant. Among new reinforcing steel projects of 13,900 tons are 7850 tons for buildings at the Brooklyn Navy Yard.

News of Industry

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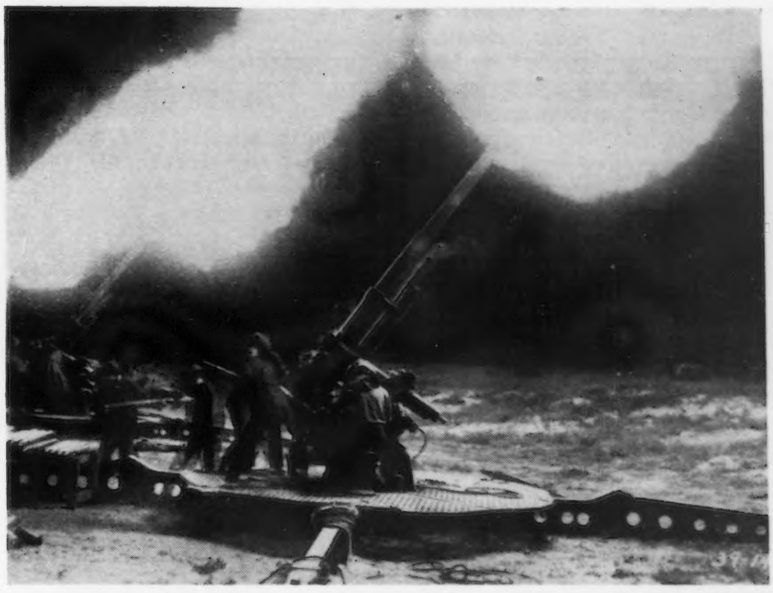


Photo by Wide World

ANTI-AIRCRAFT GUNS at Hawaii: This week these 75 m.m. anti-aircraft guns at Oahu, Hawaii, were fired at raiding Japanese planes which caused widespread damage to American possessions in the Pacific.

U. S. At War; Industry To Go "All Out"

o o o

• • • **The metal industry** of the United States at midweek was rapidly being placed on a war footing as a result of the full-blown emergency created by Japan's attack on American ships and possessions in the Pacific.

Managers of defense plants threatened or already hit by strikes, and labor union leaders were expected to close their ranks and end work disputes to reach all-out production of guns, ships, tanks and planes.

From all of the big U. S. industrial centers came word that special guards were being thrown about vital plants, that new steps, resulting from the war declaration, would soon result in the smashing of production records of vitally-needed war equipment.

Since modern war is largely a clash of steel industries, industry in the U. S. takes comfort from the fact that the U. S. alone can produce three tons of steel for every two tons that can be manufactured by Japan, Germany, Italy and all Axis-dominated countries put together.

Combined steel capacity of the U. S., the British Empire and Russia is considerably more than twice the Axis total. Even if two-thirds of the Russian capacity should fall into German hands, the U. S. and the Allies could still make 60 per cent more steel than Germany and the rest of the world.

Japan's steel capacity is about 7,100,000 tons a year, based on its output last year, the American Iron and Steel Institute estimates, a total that is less than 9 per cent of U. S. capacity which by the end of 1941 will be approximately 88 million tons.

At all the important defense plant centers, IRON AGE observers reported that a "new feeling of urgency" would result in quick increases in output of war goods.

At the same time it appeared likely that the flow of production of vital materials to non-defense plants might be reduced still more or be cut off entirely until every possible demand of the armed forces and their supplying plants had been met.

In all parts of the industrial U. S., in its steel and machine tools plants, in its automobile plants and its metal product plants of every kind, it seemed that war's danger had brought unity.

↓ ↓

Pittsburgh Seeks "More Than All-Out" Production

• • • **At Pittsburgh,** plans were completed to anticipate any and all requests from Washington for a "greater than all-out production" for defense and war purposes.

While defense orders have been given the green light for months, responsible sources here believe that as much steel production as possible will be concentrated exclusively upon products for the use of the Navy, the Army, the Maritime Commission, and lend-lease customers.

With the railroads expected to play an important part in defense because of the necessity for expeditious handling of men and war materials to all parts of the United States, it is believed that steel supplies for the railroads and car builders will soon be given a much higher priority position than is now the case, with actual allocations within the realm of probability, according to

observers here. It is believed here that the state of war will produce requirements far in excess of 300,000 tons a month for the Army and Navy.

Keen interest is expressed here over the position lend-lease requirements will take now that this country is actively at war. While no official information was forthcoming this week the opinion here is that lend-lease needs will continue to be supplied concurrently with tremendous augmentation of United States Army and Navy requirements.

Rapid strides are expected to be made this week or next toward more or less complete allocation of major steel products.

Steel tonnage which has priority ratings well down the list is now in much the same position as essential civilian requirements were a few weeks ago.

Although primarily concerned with the production of steel for war and defense, the Pittsburgh district also includes hundreds of plants which are working on direct war material, and anti-sabotage measures were placed in effect early this week at substantially all of these plants.

Although work has been going steadily forward on the Government sponsored steel expansion program at Carnegie-Illinois Steel Corp.'s Homestead, Duquesne and Edgar Thomson plants, it is likely that additional speed will now be sought.

The state of war is also expected to hasten plans for the formation of a comprehensive steel consulting committee composed of experienced steel officials on which detail is mentioned elsewhere in this issue of THE IRON AGE.

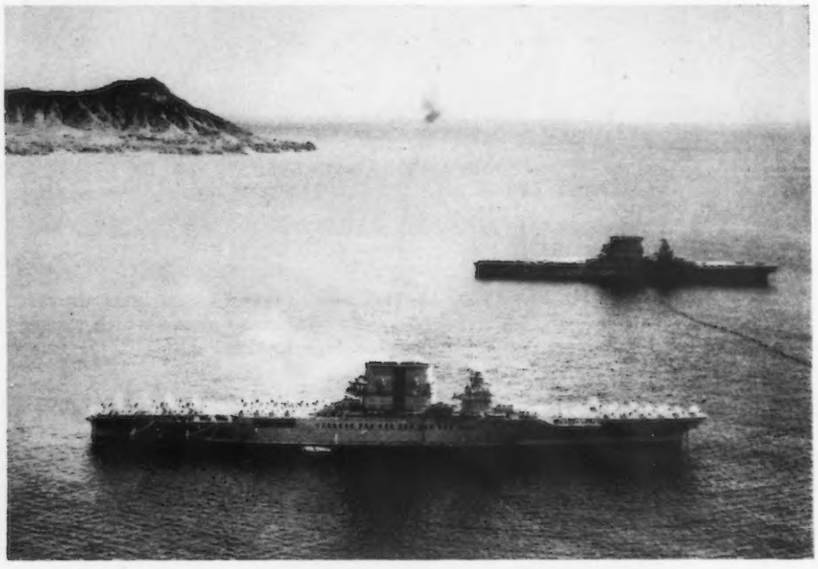
Labor observers here believe that there is practically no chance that the SWOC will attempt any stoppage of work in steel mills in its avowed effort to obtain closed or union shop despite the granting of this provision in the captive mines.

One serious obstacle toward the realization of complete all-out production in the steel industry is the threat of a scrap shortage which may materialize to a serious extent at any moment. Observers here believe that under the circumstances all steel companies will somehow be furnished necessary scrap supplies so that no interruption will occur on those orders which are actually for war purposes. This might mean, it is said, that steel companies holding greater defense requirements than others, will have first call on available scrap and the actual commandeering of scrap supplies was well within the realm of possibility.

Information obtained by THE IRON AGE here indicates that if tin plate requirements are considered to be in the defense category,

U. S. AIRCRAFT CARRIERS: Pictured off Diamond Head, Honolulu, are the U. S. aircraft carriers, Saratoga and Lexington.

Photo by Wide World



U. S. WAR BIRDS: These bombing and fighter planes are shown in the flight deck of an unidentified aircraft carrier during recent maneuvers in the Pacific.

Photo by Wide World

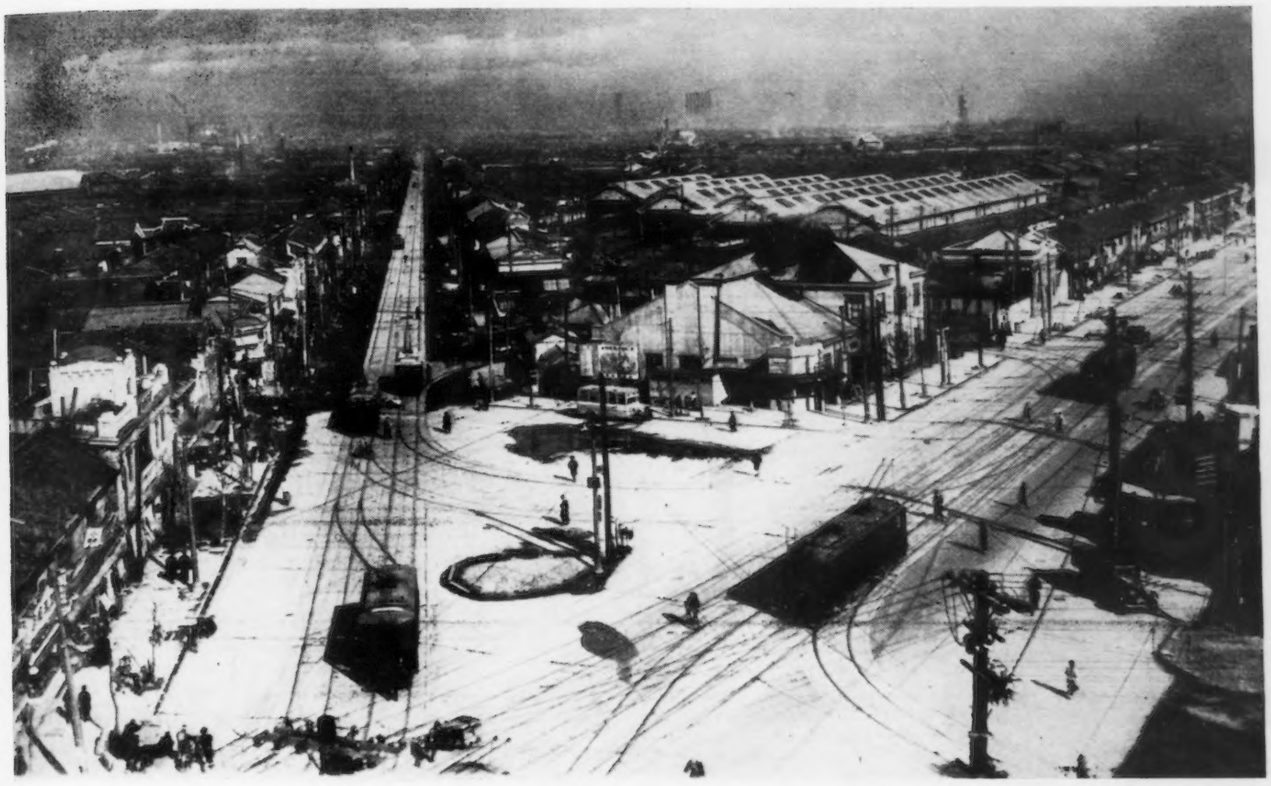


Photo by Wide World

U. S. BOMB TARGET: The important Japanese industrial city of Osaka, pictured here, is likely to be high on the list of bombing objectives for U. S. and Russian air fleets. Shipyards vital to Japan are at Osaka where many large industries are located.

actual rolling mill schedules here on defense rated steel tonnage are 70 to 80 per cent of the total.

War Speeds Output In Michigan Plants

• • • **Industry was electrified** by news of the start of the war with Japan and the tempo in the machine tool industry and defense plants was markedly faster in Detroit on Monday. One evidence of the speeding up of the industrial pace was the jam that existed on long distance phone lines and other lines of communication. The unprecedented wave of inter-city messages caused delays in getting trunk lines and appreciably slowed up transmittal of messages. Even local communications felt the jam and it was sometimes impossible to get phone calls through to the switchboards of major defense plants in this area.

Knowing that the pressure for defense production is nothing yet compared with what it will be, industry nevertheless can not open the throttle one notch farther until more orders and further instructions are received from the government. As it is, industry is proceeding at full speed with tooling and in production of such items as have reached the production stage. Tanks, airplane parts, machine guns and shells are the principal output of the plants in this area to date.

One of the first steps to tighten up protective bars against sabotage was one taken by Chrysler Corp. Monday in issuing an order stopping all visitors to its tank arsenal. Aside from protection, such steps as this are likely to be taken to avoid any possible interference with defense work or slowing down of war effort. Broadly speaking, plant protection efforts have not changed, principally because methods of plant protection have been progressively improved during the past two years. John Bugas, Detroit director of the local branch of FBI, has had his staff working since the start of the defense program to tighten up protection around local plants and others in Michigan which will contribute to the defense effort. The FBI office stated Monday that all manufacturers are expected to be more vigilant now and that a special tightening up in the protection around plants of public utilities is to take effect immediately.

Troops from Selfridge Field were immediately placed on guard at the Ambassador bridge and the Detroit-Windsor Tunnel and special efforts were taken to protect the railroad tunnel under the river which serves the Michigan Central Railroad and others. Army officials engaged in plant protection efforts refused to comment on reports that troops were prepared to move from Fort Custer at Battle Creek, Mich., to guard defense plants.

From Army plant protection authorities came the suggestion that any plant engaged in defense work, as a sub-contractor or otherwise should take immediate steps

to have its plant protection set-up surveyed by the branch of the service for which the defense work is being done. It is known that many plants engaged in the defense program in a secondary way have been relying merely on normal protection devices and set-ups.

Seven-day operation of defense plants has been discussed in Detroit for several weeks but has been hung up on the controversial issues that have arisen between employers and the CIO. Four-shift operations, on a swing shift basis, with bonus payment to equalize wages paid various groups of workers and to make up for the overtime provisions of union contract agreements, have been discussed but no action has been taken yet. Now that the country is on a definite war-time basis, the change to seven-day week operations may be speeded.

One instance of the addition of extra plant protection men is at Ford Motor Co., which is expanding its protection group to guard the Willow Run bomber plant, now nearing completion.

In some plants where office workers formerly were not required to show badges to get into office areas, orders went up this morning requiring this formality.

On Sunday afternoon Gov. Murray D. Van Wagner issued orders to the state troopers to be on the alert and ready for special duty.

CANADA AND THE WAR: Off the assembly line at the Angus Shops in Montreal, these infantry tanks are ready for fitting with 2-pounder machine guns, flame throwers and other equipment. The Dominion has promised Russia 100 of these tanks, which cost about $90,000 each, weigh 20 tons, and have a top speed of 25 m.p.h.

Ohio Sees Better Allocation of Steel

• • • **In Cleveland,** with the United States actually at war, steel executives prepared for greater demands for steel from our armed forces to be poured into machinery operating at an "all-out" rate to turn out the implements of war. Better allocation of steel by Washington was believed likely. Simultaneously, non-defense applicants for steel were being given sterner treatment than they have received at any time since Sept. 1, 1939.

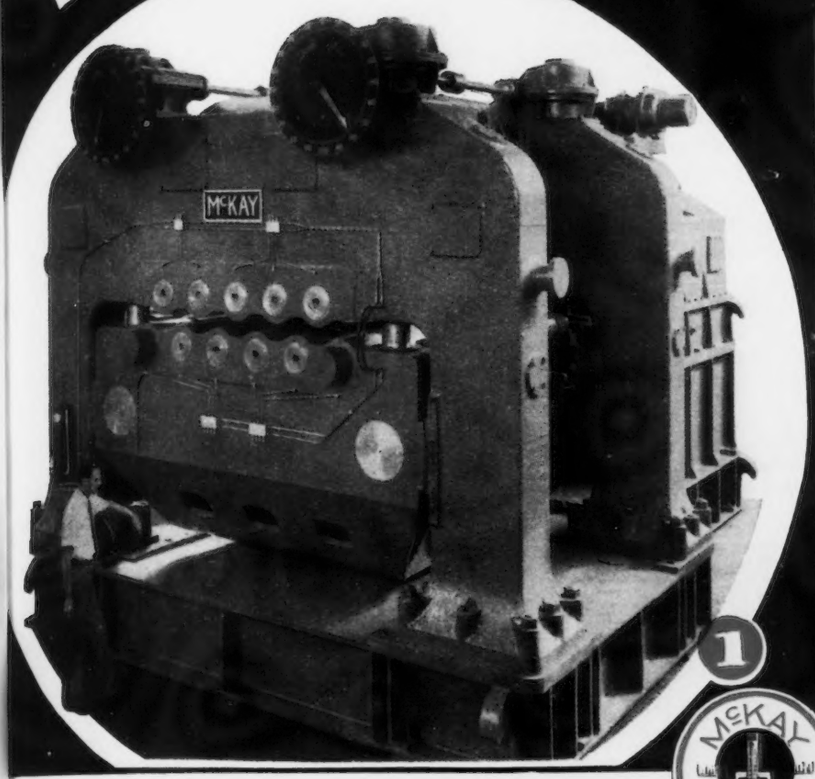
One executive expressed the opinion that the OPM probably would be forced to abandon a large measure of the aid that it has been extending to non-defense plants to keep them in business, since war is expected to dull federal sympathy in certain directions where the disruptions of war will have to be sustained. Since some munitions plants have not been operating on a 24-hr. basis, seven days a week, the present crisis is expected to place them on an "all-out" schedule, thereby requiring more steel for tanks, gun carriages, shells and other war implements. Some diversion of shipments of material from the British to the American armed forces is likely, although some aid to Russia, China, the Dutch and the British will be continued.

The use of steel shell casings appears likely to be pushed, especially in view of the pinch in copper and brass shaping up for 1942. It is reported that "educational" orders have been placed already with three Ohio concerns, while awards for brass shell casing, for which bids were taken several weeks ago, are being delayed. The greater demand which our "shooting war" will impose for shells should result in larger allocations of bar stock for shells, and wider use of sheet steel in making shell casings. General allocations may be in the making for bars.

Industrial plants were being carefully guarded here, and even warehouses were exercising care

McKAY

1. The McKay Heavy Duty Roller Leveller.
2. The Budd-McKay Processing Machine.
3. McKay Heavy Duty Backed-up 4-Hi Plate Leveller.
4. Backed-up Roller Leveller.



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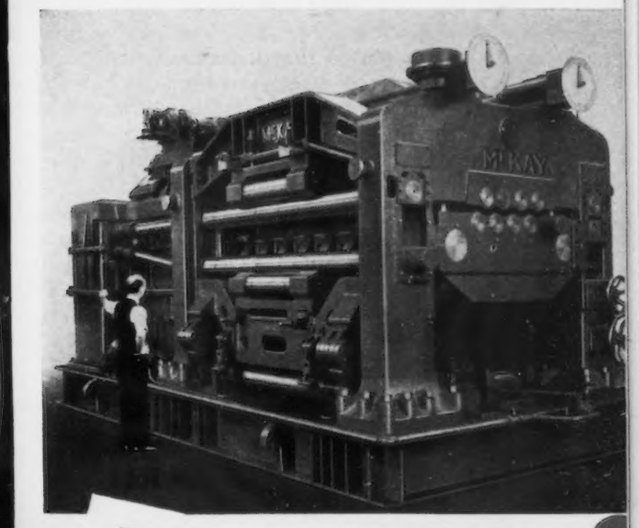
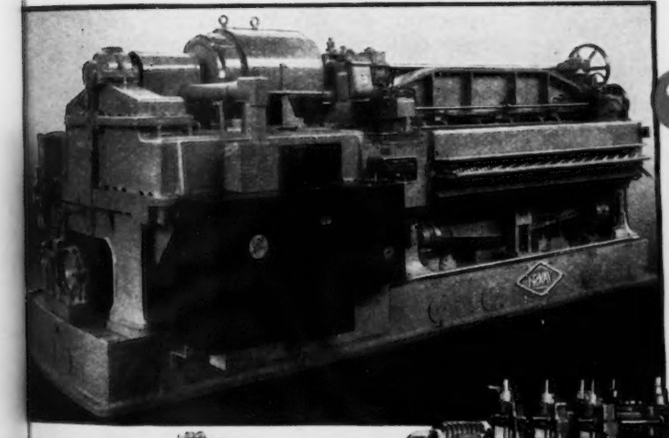


3

McKAY
McKROMETER
ADJUSTMENT



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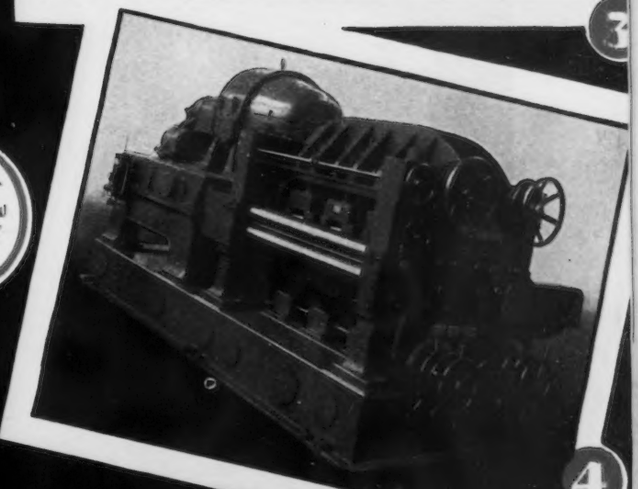


4

5. McKay Electric Tube Welder.

5

The McKAY MACHINE Company
ENGINEERS AND MANUFACTURERS OF SHEET, TIN, AND STRIP MILL EQUIPMENT
YOUNGSTOWN, OHIO
ASSOCIATED COMPANY
The WEAN ENGINEERING CO., Inc. • WARREN, OHIO

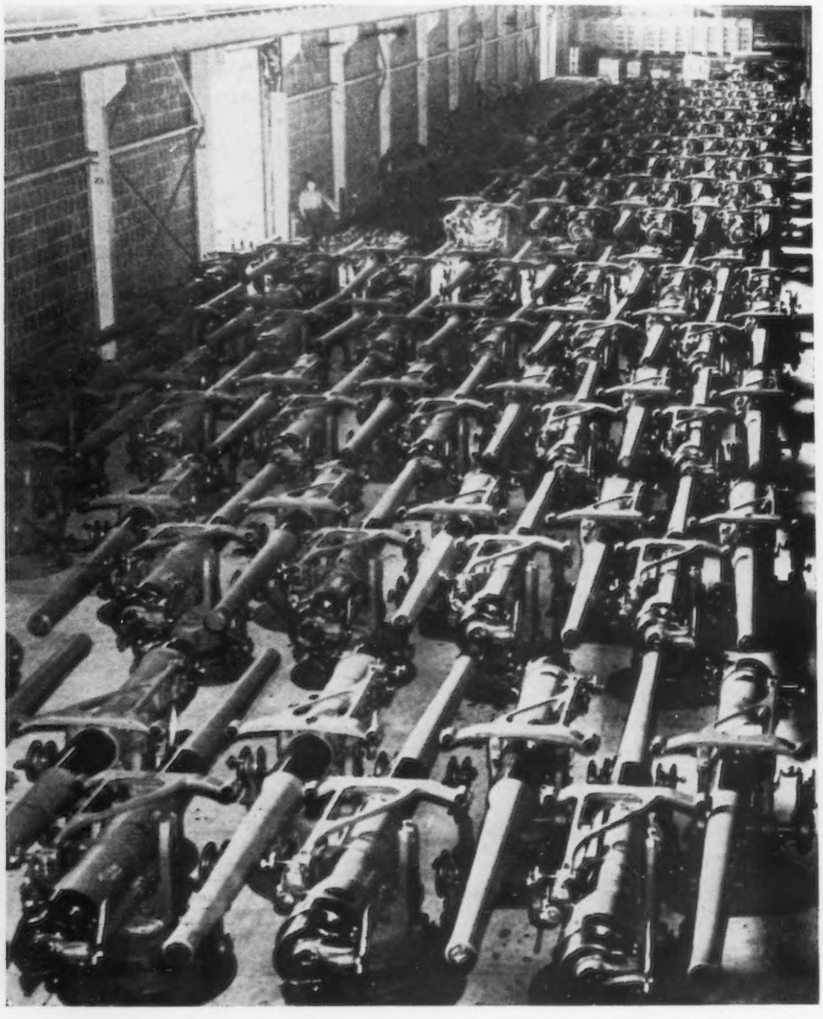
against sabotage. Meanwhile, the Ravenna strike and that at Cleveland Brass were called off, as labor appeared to abandon its apathetic attitude to the "national emergency" in favor of serious reaction to war.

Speaking for his industry, Tell Berna, secretary of the National Machine Tool Builders' Association, stated that machine tool builders have been engaged in working toward the defense of this country from foreign danger since Sept. 1, 1939, and while they have been working under terrific pressure, the "new sense of urgency" attached to our present state of war might permit even higher production records.

Pig iron men, who faced greater defense demands in the December allocations made by Washington, expected that fewer tons of iron would be available for non-defense consumers with B ratings. This expectation is strengthened by the fact that foundries with defense orders have been unable to secure sufficient cast-grade scrap, which is one of the serious shortages in this area. The OPM has been making allocations of cast scrap to foundries with defense orders, but these plants may be forced to make greater demands, upon the pig iron producers.

Scrap dealers were hopeful that the outbreak of war would result in greater scrap collections from persons holding scrap for higher prices, as well as from owners of scrap who merely have neglected its collection or marketing. It is expected that appeals to patriotism would bring out more scrap now than such appeals did months ago.

GUNS FOR MERCHANT SHIPS: At the Philadelphia Navy Yard, these guns are being stored awaiting distribution and installation aboard merchant ships, in the "deliver the goods" program permitted by repeal of the Neutrality Act.



Chicago Industry Says: We're Ready

• • • **Most important** impact in the midwest of the war with Japan was the immediate crystallization of feeling among all manufacturers, big and little. Unlike the East and West Coasts, traditional isolationists of the Midwest still pervaded the thought and actions of industry. But in less than 24 hr. the change to "we are all together now—let's go" took place.

Though spokesmen for the principal industries could predict no specific effects of the formal declaration of war on their own fields, all concurred in the one thought "we are ready to do whatever the government asks us to do—and we will do it with all our heart."

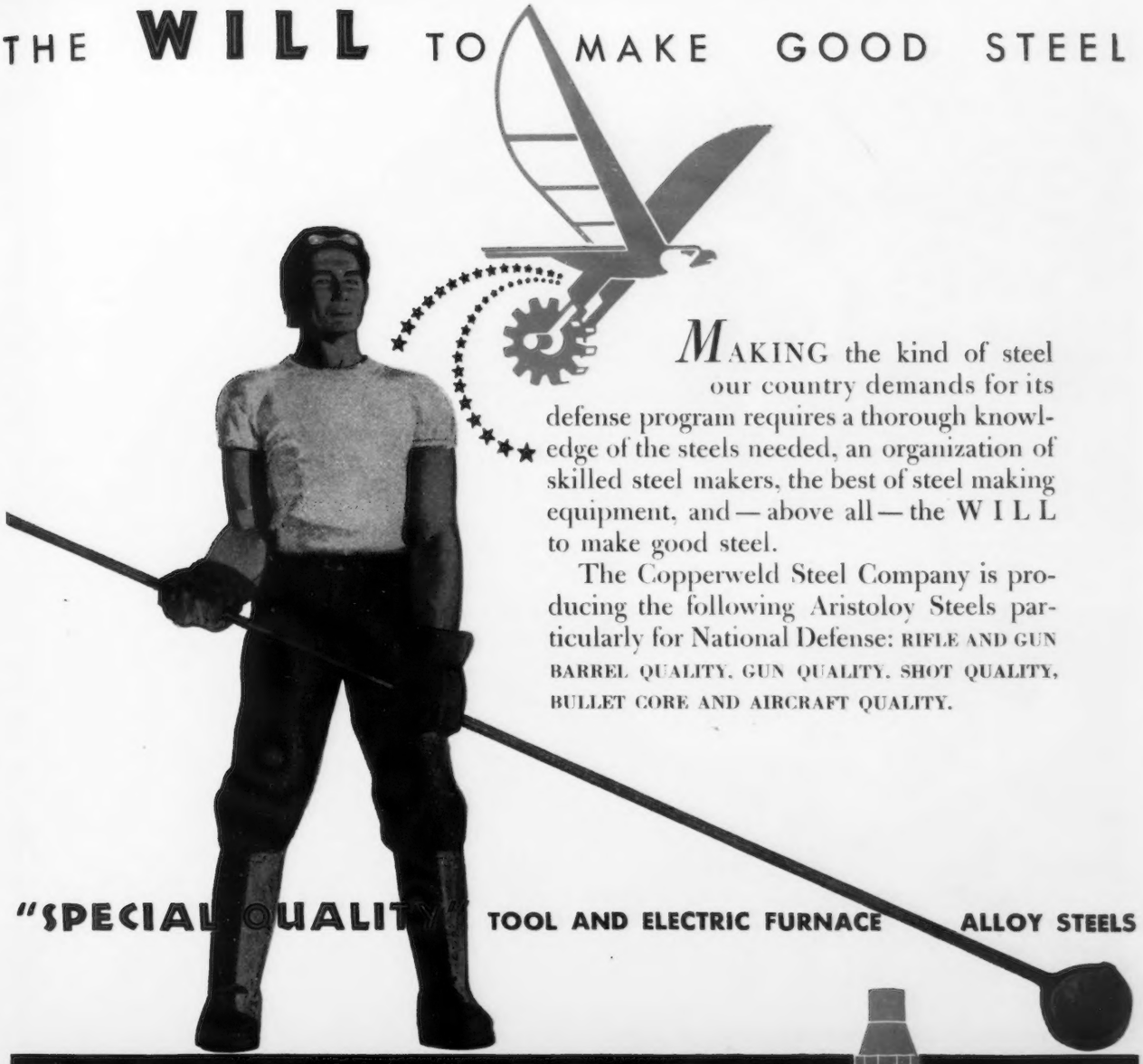
International Harvester Co., one of the giants of the farm equipment industry and a huge defense contractor, threw extra cordons of plant police protective forces around all their plants on the same day—Sunday—that the War Department requested industry to guard against sabotage. Most farm equipment manufacturers are important defense contractors and all followed suit. No one was willing to hazard a prediction as to the effect of the war on their production of farm tools.

The steel industry in this section is holding itself in a state of suspended readiness. Some leaders thought there might be all out allocation on all steel products but the general tone of the producers was similar to that of other industries—that of readiness to follow orders and avoid individual assertions as to what would or should happen.

Steel mills in the Chicago area cannot increase their plant protective forces since they have all been on a war time footing for months. But there will be practically no outside visitations of any kind permitted, photographs in the mills will be completely forbidden and general tightening of similar restrictions has immediately gone into effect.

Machine tool manufacturers already working at their peak for

THE **WILL** TO MAKE GOOD STEEL



*M*AKING the kind of steel our country demands for its defense program requires a thorough knowledge of the steels needed, an organization of skilled steel makers, the best of steel making equipment, and — above all — the W I L L to make good steel.

The Copperweld Steel Company is producing the following Aristoloy Steels particularly for National Defense: RIFLE AND GUN BARREL QUALITY, GUN QUALITY, SHOT QUALITY, BULLET CORE AND AIRCRAFT QUALITY.

"SPECIAL QUALITY" TOOL AND ELECTRIC FURNACE ALLOY STEELS

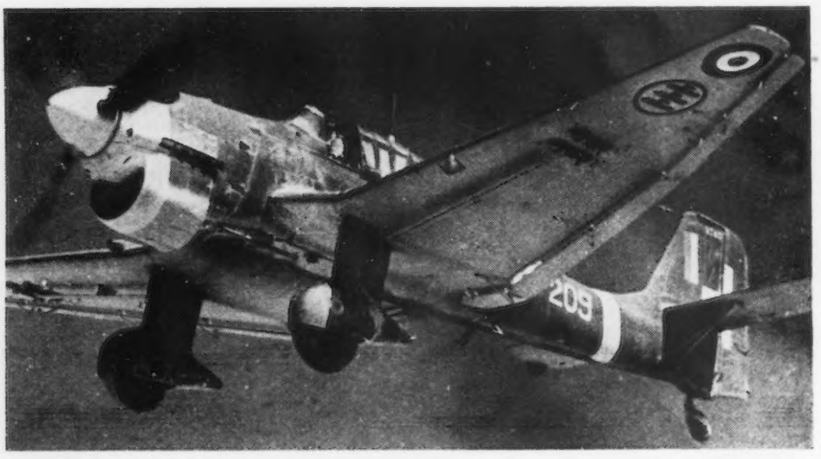
CARBON TOOL STEELS
ALLOY TOOL STEELS
STAINLESS STEELS
NITRALLOY STEELS
AIRCRAFT QUALITY STEELS
BEARING QUALITY STEELS

ARISTOLOY STEELS

ARISTOLOY STEELS

COPPERWELD STEEL COMPANY WARREN, OHIO

RUSSIAN ARMORED CARS: This picture, presented to Lord Beaverbrook by Stalin, shows an endless flood of armored cars moving to the front.



FROM TINKERS TO EVERS TO CHANCE: One of the squadron of German Stuka dive bombers, loaned to the Italians, that was captured by the British when the Italian pilots were forced to land because of fuel shortages. The British are using these planes, and they bear both the British and Italian insignias on the wing tips.

some time and 100 per cent on defense stated there was little change the war could make in their picture.

↓ ↓

Armed Forces May Direct U. S. Output

• • • **Japan's attack brought** immediate expectations at New York that the United States armament production program will be altered sharply.

First, it is expected the armed forces will command production more directly than in past months. The pleading attitude adopted by OPM Director General Knudsen, who frankly admitted his lack of power, will be replaced by forceful direction by the armed forces. There was evidence here last week of a sterner attitude on the part of the Navy in its steel purchases. When one company disagreed with the Navy over "price in effect" stipulations it was sharply told to deliver the steel and sue the government on the price question.

In a state of war such as exists now, the president may take over industrial plants, transportation systems and other facilities, commandeer stocks, increase hours of work, suspend laws and establish rigid controls.

Apportionment of funds may be disregarded by the armed forces. Formalities in making purchases, such as advertising for bids, may be dispensed with.

The ammunition program, which has been comparatively slow since the defense plan started, is expected to be pushed aggressively.

CRASH MYSTERY: An entire squadron of Nazi dive bombers, piloted by Italian flyers, was forced down behind British lines because of fuel shortage. It was reported that the bombs, still intact under the fuselage and wings, could not be released. The ships bore Italian markings and were fitted with wooden propellers. The crew of this ship, after a miraculous escape, left a message that indicated they had wandered away in the desert.

TRANSUE & WILLIAMS

Designers and Makers of Deep Drawn Stampings

ALLIANCE · OHIO

SALES OFFICES: NEW YORK, PHILADELPHIA, CHICAGO, DETROIT, INDIANAPOLIS, CLEVELAND

A great number of manufacturers today have had to face a sharply diminished supply of parts made from materials vital to the defense program. Popular move among them has been a change to pressed steel. Through its extensive experience in, and facilities for, both design and production of steel stampings, Transue has proved a completely satisfactory source for such parts or products. If you are in a similar situation and desire a practical, thorough analysis of the possibilities of pressed steel as your answer, you are invited to consult with Transue's widely experienced personnel. No obligation, of course.

Closed Shop Given In Captive Mines

• • • **President Roosevelt's** three-man board arbitrating the dispute in the captive coal mines issued its decision on Dec. 7 and directed eight large steel companies to accept the closed shop. John L. Lewis and Dr. John R. Steelman cast the votes in favor of the union. Benjamin F. Fairless, president of United States Steel Corp., dissented.

The companies and the union agreed in advance to accept any ruling of the board. The decision reversed a National Defense Mediation Board ruling which precipitated a seven-day strike.

Workers in the captive mines will be required to join the United Mine Workers' Union. Companies affected by the decision are United States Steel Corp., Wheeling Steel Corp., Republic Steel Corp., Crucible Steel Corp., National Steel Corp., Youngstown Sheet & Tube Co., Bethlehem Steel Co., Woodward Coal & Iron Co.

In his dissenting opinion, Mr. Fairless said: "The decision imposes a closed shop on the so-called 'captive' coal mine operators, who are parties to this arbitration. Their operations have heretofore always been conducted on the open shop principle over a long period of years. There is no possible justification for a change in this basic labor relationship at a time of national crisis. That decision further imposes an unregulated labor monopoly upon the entire bituminous coal industry. It does not confer one single benefit on the workers in the 'captive' coal mines. Their wages, hours or working conditions are in no way improved. The only beneficiary is the already powerful United Mine Workers of America, whose membership already embraces about 95 per cent of the workers in the bituminous coal industry.

"That decision violates the fundamental right of the American worker to a job regardless of membership or non-membership in any organization.

"That decision runs counter to the statement publicly made by President Roosevelt on Nov. 17, 1941, when he said: 'I tell you frankly that the government of the United States will not order, nor will Congress pass legislation ordering, a so-called closed shop.'"

Dr. Steelman said the decision "may well serve the national emergency by contributing to unity and assuring continuity of maximum coal production."

"The union shop is being sought here, in every realistic sense, to confirm and consolidate the position the union has already achieved," he declared. "The status quo, as I see it in this case, will not be affected in any important way by the granting of the union shop by these few employers."

War Should Unify U. S., Steel Leader Holds

• • • "The war should unify our thinking," J. C. Argetsinger, vice president of Youngstown Sheet & Tube Co., told THE IRON AGE in expressing his ideas on general reaction to Japan's attack on the United States. "The uncertainty as to whether or not we are at war has been removed, and this should open the eyes of people who have been doing a lot of wishful thinking about the question of war or peace."

Expressing the opinion that the steel industry would continue to exert its best efforts toward national defense, Mr. Argetsinger stated that the national realization of the severity of the present situation should result in new production records.

WAR WRECKAGE: Somewhere east of Kiev, the Nazi censor-approved caption states, the fourth Soviet Army was surrounded and wiped out. Visible are miles of wrecked trucks, tanks, and military equipment that speak of a terrific battle in which the Nazis proved superior.

United Engineering to Expand at Youngstown

Youngstown

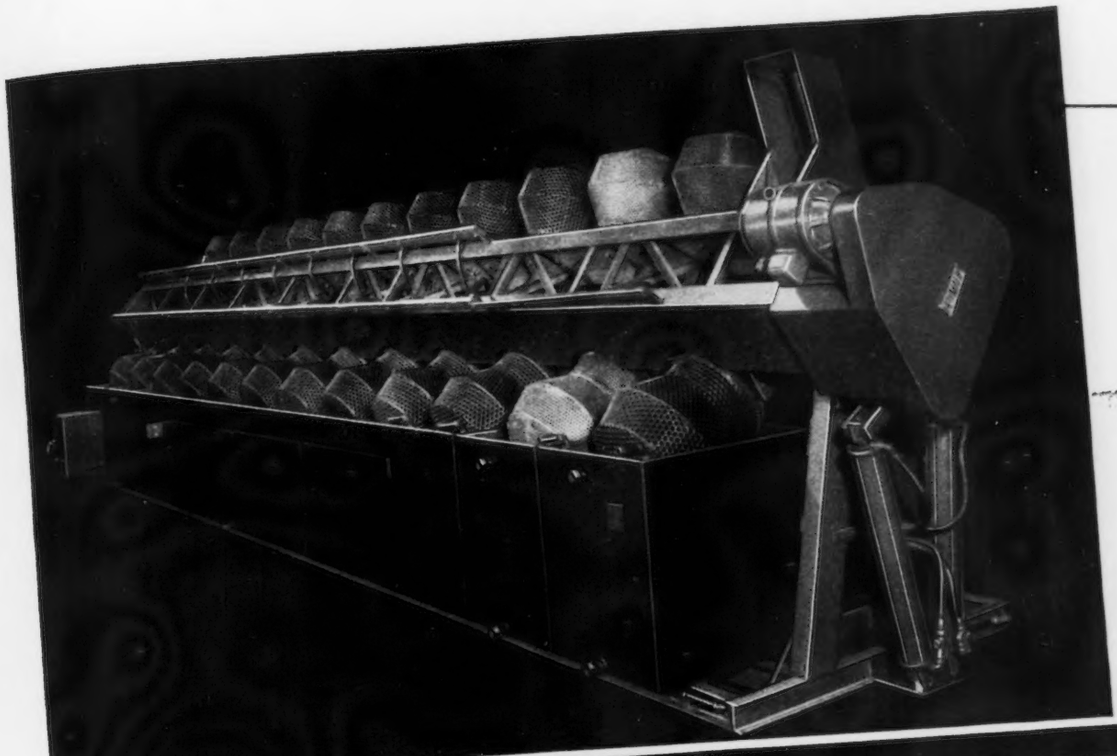
• • • **United Engineering** & Foundry Co. announces plans for a $500,000 addition to its Youngstown plant. A new building recently constructed by the company is being used as an assembly plant for two huge hydraulic presses for the Navy, to be used in the pressing of armor plate, while the new addition will be used as an assembly plant for heavy machinery being constructed here.

United Engineering is working on large national defense orders, turning out howitzers for the U. S. Army, some U. S. Navy contracts, in addition to orders for steel mill rolling equipment. Operations are now going on day and night, seven days a week.

Baltimore Steel Party, Dec. 19

Baltimore

• • • **The fourth annual** Christmas party of the Steel Club of Baltimore will be held Friday, Dec. 19, in the main ball room, Belvedere Hotel. Adolph Rider, Jr., of Lukens Steel Co., is chairman of the entertainment committee.



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Automatic Barrel Cleaning and Plating Machine

For plating, cleaning, pickling, rinsing, drying of small parts, the Udylite full automatic barrel plating and cleaning machine is the ideal unit. It is fully automatic—no manual handling is required. It can be used for any combination of dipping processes and can be converted to new dipping cycles without great expense.

The machine is compact. Processing time may be closely controlled. Unit is furnished for air or hydraulic operation

Many national defense contracts call for special plating, cleaning, pickling and rinsing operations on small parts. Let us figure on a machine which will carry out these operations automatically. Many are now in operation and can be inspected by appointment.

For

★ Cleaning and pickling brass cartridge cases.

★ Special cleaning, pickling, rinsing small parts.

★ Zinc, cadmium, copper, lead, brass, tin plating small parts.

★

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Chicago
1943 Walnut Street

Cleveland
3756 Carnegie Ave.

PRESENT PLATE MILLS FOR SHEARED PLATES ESTIMATED CAPACITIES

Company	Location	Mill	Plate Width	Capacity in Gross Tons Per Year
Alan Wood Steel Co.	Conshohocken, Pa.	84"	76"	100,000
Allegheny Ludlum	Brackenridge, Pa.	110"	102"	85,000
Armco	Ashland, Ky.	58"	52"	
Armco	Butler, Pa.	48"	44"	11,500
Armco	Middletown, Ohio	80"	76"	
Bethlehem Steel Co.	Sparrows Point, Md.	114"	108"	140,000
Bethlehem Steel Co.	Sparrows Point, Md.	160"	152"	200,000
Bethlehem Steel Co.	Lackawanna, N. Y.	79"	72"	30,000
Bethlehem Steel Co.	Johnstown, Pa.	134"	128"	150,000
Carnegie-Ill. Steel	Homestead, Pa.	86"	80"	65,000
Carnegie-Ill. Steel	Homestead, Pa.	141"	140"	225,500
Carnegie-Ill. Steel	Homestead, Pa.	100"	96"	720,000
Carnegie-Ill. Steel	Gary, Ind.	160"	....	200,000
Carnegie-Ill. Steel	So. Chicago, Ill.	96"	90"	720,000
Carnegie-Ill. Steel	So. Chicago, Ill.	90"	....	120,000
Central Iron	Harrisburg, Pa.	126"	120"	100,000
Central Iron	Harrisburg, Pa.	89"	83"	40,000
Crucible Steel Co.	Pittsburgh, Pa.	24"	20"	16,900
Disston	Tacony, Pa.	80"	72"	5,000
Inland Steel	Chicago, Ill.	103"	97"	100,000
Jessop Steel	Washington, Pa.	76"	70"	3,350
Jones & Laughlin	Pittsburgh	128"	....	150,000
Knoxville	....	....	....	900
Lukens Steel Co.	Coatesville, Pa.	204"	200"	210,000
Lukens Steel Co.	Coatesville, Pa.	140"	134"	
Lukens Steel Co.	Coatesville, Pa.	112"	108"	90,000
Lukens Steel Co.	Coatesville, Pa.	84"	80"	65,000
Otis Steel Co.	Cleveland, Ohio	....	....	75,000
Otis Steel Co.	Cleveland, Ohio	152"	....	.....
Otis Steel Co.	Cleveland, Ohio	77"	72"	45,000
Pine Iron Works	Pine Forge, Pa.	96" & 84"	90" & 80"	22,000
Republic Steel	Youngstown	84" & 60"	....	150,000
Republic Steel	Gadsden, Ala.	22" x 90"	....	168,000
Sheffield Steel	Kansas City	66"	....	11,500
T. C. I. & R. R. Co.	Fairfield, Ala.	110"	....	160,000
Worth Steel	Claymont, Del.	160"-120"	....	228,000
Youngstown Sheet & Tube	Youngstown	110"	....	215,000
				4,622,650

SUMMARY OF PLATE PRODUCING CAPACITIES

	Long Tons Per Year	Short Tons Per Year	Plates Available for 1942 if Wisely Specified and Scheduled
Sheared Plates	4,622,000	5,177,000	5,177,000
Universal Plates	1,435,300	1,607,536	1,607,536
Strip Mill Plates	3,200,000	3,580,000	.....
Strip Mill Plates reduced by 35%	.....	2,327,000	2,327,000
			9,111,536

NOTE: Estimated steel plate requirements for 1942 total 8,500,000 tons.

Utilizing Plate Capacity for the Defense Program

• • • Recently THE IRON AGE published Arthur G. McKee's opinion that "present plate capacity would meet current defense requirements, if wisely scheduled." Meanwhile, an OPM representative at the Cleveland priorities clinic estimated that only 600,000 tons of plate were being produced at present, as against current requirements of 950,000 tons a month.

To back up Mr. McKee's opinion of the plate situation, the accompanying tables are published indicating what might be done with our present plate, sheet, and strip mill capacities, by proper allocations, either with or without additional equipment being installed. This would still leave available sufficient capacity for defense requirements of sheet and strip steel, plus some non-defense tonnage, according to McKee who is president of Arthur G. McKee & Co. The summary indicates that 9,111,536 net tons of plates could be turned out next year with present equipment, if wisely scheduled, whereas with the addition of certain equipment the United States would have a plate-making capacity of 19,827,450 gross tons, as may be traced on the accompanying tables.

Of course, the transforming of sheet and strip mills over to plate mills involves much more than the mere installation of shearing equipment. With some sheet mills turning out material at a rate of 2200 feet a minute, and this coiled as fast as it comes from the mill, it is apparent that considerable room would have to be made for plates in the conversion so that they may be stacked up after shearing. This would mean the knocking out of

ESTIMATED POTENTIAL CAPACITIES PLATE & STRIP

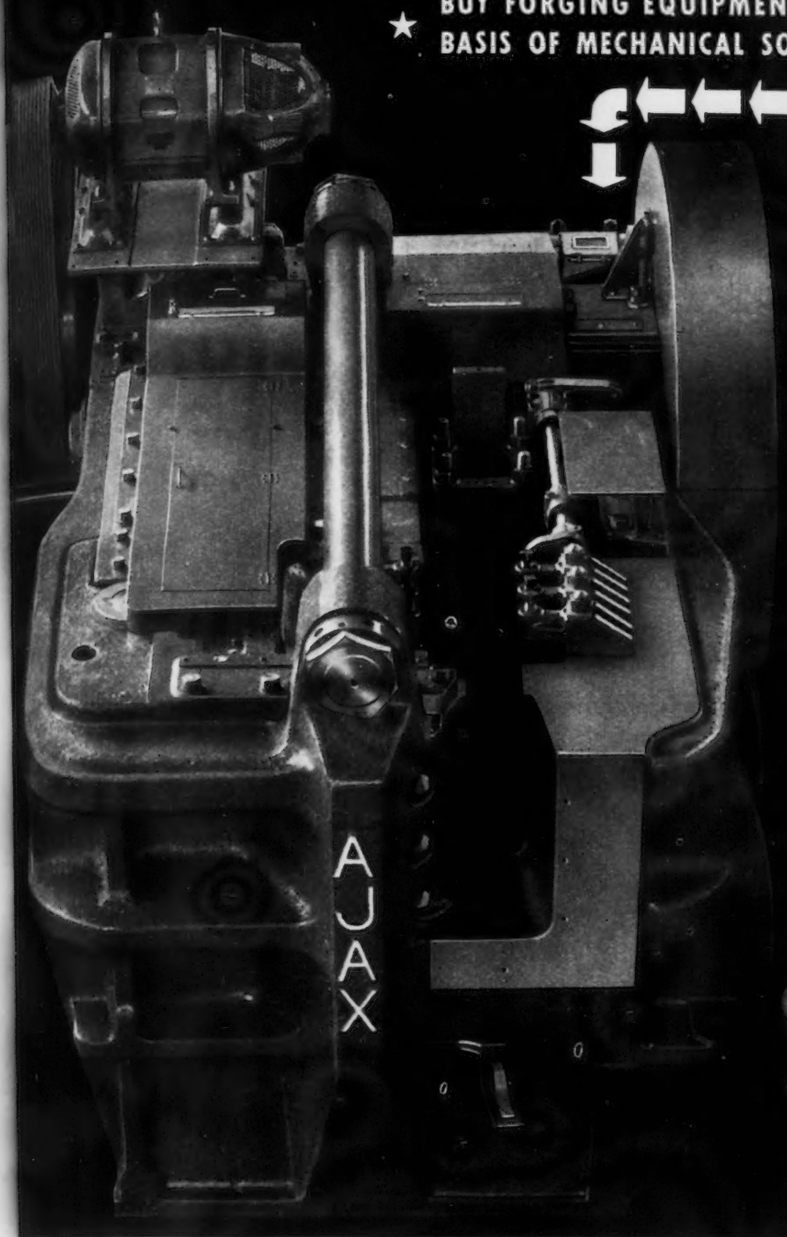
(Long Tons)

Company	Mill Width	Plate Width	Total Annual Strip Tonnage Now		Plate Capacities Per Year if Provided With Additional Equipment	Plate Capacity With Present Equipment	
Great Lakes	96"	90"	720,000	Soft Plates 3/8"	400,000	400,000	May '42
Bethlehem	79" Lackawanna	72"	720,000	1/2" or less	400,000	400,000	
Bethlehem	58" Sparrows Pt.	52"	600,000	5/16" soft	300,000	100,000	
Jones & Laughlin	96"	90"	750,000	1/2"	400,000	400,000	
Republic Steel	98"	92"	800,000	3/4"	500,000	500,000	
Otis Steel	77"	72"	500,000	5/16"	300,000	100,000	
Youngstown Sheet & Tube	79" Youngstown	73"	650,000	3/8" or less	400,000	300,000	
Youngstown Sheet & Tube	54" Ind. Harbor	48"	700,000	3/8" Soft Plate	300,000	100,000	
Armco	80"	74"	670,000	None	300,000	.....	
Wheeling Steel	66"	66"	840,000	None	400,000	.....	
Carnegie-Ill.	80" Gary	74"	700,000	5/16"	400,000	250,000	
Carnegie-Ill.	80" Irvin	74"	640,000	5/16" Soft Steel	300,000	100,000	
Weirton	54"	50"	650,000	None	300,000	.....	
Inland Steel	79"	73"	700,000	5/8" or less	400,000	400,000	
Inland Steel	44"	40"	600,000	5/16" and less	300,000	100,000	
Ford Motor	66"	60"	600,000	1/2" 300,000 later	300,000	.....	
Granite City	90"	84"	470,000	3/4" and less	200,000	60,000	
			11,310,000		5,900,000	3,210,000	

Narrow mills not included in above:
Mills over 24" up to 48" ..... 4,873,000 Tons
Mills under 24" ..... 2,996,500 Tons
7,869,500 Tons

Most of these narrow mills produce considerable tonnages of plates when and if provided with cooling beds, levelers, shears, etc., which could be installed in comparatively short time at low cost as compared to the installation of new plate mills.

★ BUY FORGING EQUIPMENT ON THE BASIS OF MECHANICAL SOUNDNESS ★



AJAX *Automatic Lubricating System* safeguards close machine clearances so vital to Precision Forging

THE FINAL FACTOR in realizing high production forging within the close limits of accuracy possible on Ajax Forging Machines is the safeguarding of the close clearances established by exacting and careful workmanship in the Ajax plant. For this, adequate automatic lubrication is absolutely necessary.

On Ajax Forging Machines wear is indefinitely postponed and the close clearances of moving parts operating under tremendous pressures are protected by the built-in, automatic lubricating system designed and constructed by Ajax especially for this purpose. A double plunger pump, completely immersed in oil and driven directly from the crankshaft by a ratchet arm, delivers lubricant at a predetermined rate to two oil distributors which, in turn, proportion it to oil pockets at each bearing. The rate of flow can be readily adjusted according to speed of operation and types of work being handled.

The extreme simplicity and ruggedness of the Ajax lubricating system and its ease of repair and adjustment eliminate the need for calling in a specialist as required with more delicate systems. The entire mechanism can be removed as a unit for inspection, adjustment or minor repair. A hand crank on the pump enables the operator to oil up before starting. Once in operation lubrication is entirely automatic.

The assurance of abundant lubrication for complete protection of moving parts and maintenance of close clearances afforded by Ajax Automatic Lubricating Systems should weigh heavily in favor of your purchase of Ajax Air Clutch Forging Machines on the basis of mechanical soundness. Write for New Bulletin 65-B.

THE AJAX MANUFACTURING COMPANY
EUCLID BRANCH P. O. CLEVELAND, OHIO
621 MARQUETTE BUILDING • CHICAGO, ILLINOIS

UNIVERSAL PLATE MILLS, ESTIMATED CAPACITIES

Company	Location	Mill Rolls	Plate Width	Capacity in Gross Tons Per Year
Bethlehem Steel Company	Sparrows Point	84"	60"	150,000
Bethlehem Steel Company	Seattle	22"	....	14,500
Bethlehem Steel Company	Johnstown, Pa.	67"	36"	120,000
A. M. Byers Company	Ambridge, Pa.	96"	90"	32,000
Carnegie-Ill. Steel Corp.	Farrell, Pa.	88"	82"	150,000
Carnegie-Ill. Steel Corp.	Gary	38"	....	100,000
Carnegie-Ill. Steel Corp.	Homestead, Pa.	88"	....	204,000
Carnegie-Ill. Steel Corp.	South Chicago, Ill.	60"	....	160,000
Carnegie-Ill. Steel Corp.	South Chicago, Ill.	67"	....	160,000
Central Iron & Steel Co.	Harrisburg, Pa.	50"	....	75,000
Colorado Fuel	Pueblo, Colo.	....	....	8,000
Inland Steel Company	....	24"	20"	40,000
International Harvester	Chicago, Ill.	24"	20"	40,000
Lukens Steel Co.	Coatesville, Pa.	66"	48"	70,000
Republic Steel Corp.	Warren, Ohio	42"	....	100,000
T. C. & I. Co.	Fairfield, Ala.	110"	....	11,800
				1,435,300

walls in some sheet and strip plants, and the building of sizable extensions, not to mention hoisting equipment, cooling beds, levelers, and considerable shearing equipment. Moveover, the conversion of sheet and strip mills over to plate means making idle coiling equipment, annealing and pickling equipment, and throwing out of work men all along the line.

One drawback to operating the plate and large strip mills at capacity is the number of "5 and 10 cent mixtures" among orders. One way to lessen such ordering would be for shipyards, arsenals and other big users to carry a greater stock of large plates which they themselves can shear up for small sizes and into the necessary small quantities.

Olds To Make Tank 75's And Armor Piercing Shot

Detroit

• • • **Olds Motor Works Division** of General Motors Corp. has announced that it will make 75 mm. semi-automatic guns for medium tanks. Eight million dollars for new machinery has been allotted and $250,000 for plant re-arrangement. The three principal parts of the gun, the tube, breach ring and breach block will be manufactured by Olds; the other 67 parts will be sub-contracted.

It is estimated that 8000 workers will be employed on the 75 mm. gun, the 20 mm. gun which Olds previously had contracted to make, and on shells.

The shell plant will shortly manufacture a 75 mm. armor piercing type of shot. This order, which totals $35,705,287, will be shared by Chevrolet.

Sweet's Catalogs Include Machine Tool Section

• • • **For the first time,** Sweet's Catalog Service, New York, has prepared a machine tool section. It includes condensed catalogs of 20 machine tool builders, and is available in a separate bound volume.

Products of the following companies are represented: American Broach & Machine Co., Bodine Corp., Carlton Machine Tool Co., Cincinnati Milling Machines & Cincinnati Grinders, Inc., Fellows Gear Shaper Co., George Gorton Machine Co., R. F. LeBlond Machine Tool Co., Liberty Planers, Inc., A. H. Nilson Machine Co., Oster Mfg. Co., Rockford Machine Tool Co., Schauer Machine Co., Sebastion Lathe Co., Sheffield Corp., South Bend Lathe Works, Steelweld Machinery Co., Sundstrand Machine Tool Corp., Van Norman Machine Tool Co., Walker-Turner Co., Inc., and Warner & Swasey Co.

New Curtiss-Wright Plane Factory Dedicated

Columbus, Ohio

• • • **Curtiss-Wright's new** $14,000,000 airplane factory was dedicated last Thursday. A thousand prominent Ohioans and visitors from other places saw for the first time a modern airplane factory at work. J. A. Williams, plant manager, told the visitors that by Oct. 1, 1942, the present 3600 employees would grow to 13,000.

OPM To Allocate Tin Plate Orders for Latin America

Washington

• • • **Allocations for the shipment** of 218,600 metric tons of tin plate to Latin America during the year begun last Monday will soon be made to American mills by OPM. Thirty-five per cent of the total is to be exported within three months. Agreement to supply the tin plate, which will partly make up for halted European exports, was made by SPAB at the request of the Economic Defense Board. In 1940 Latin America imported 233,600 tons of tin plate.

After allocation the business will move through the usual trade channels. SPAB said the plan is "expected to eliminate the price-gouging on tin plate which has recently been reported by a number of Latin American importers."

In preparation for the new plan, all licenses for export of tin plate to Western Hemisphere nations have been revoked as of Dec. 15. "In the future, the governments of importing countries will have an opportunity to recommend approval or disapproval of orders by individual importers," SPAB said. "These recommendations will be given full consideration by the Economic Defense Board."

Machine Gun Making at Buffalo Studied by Group

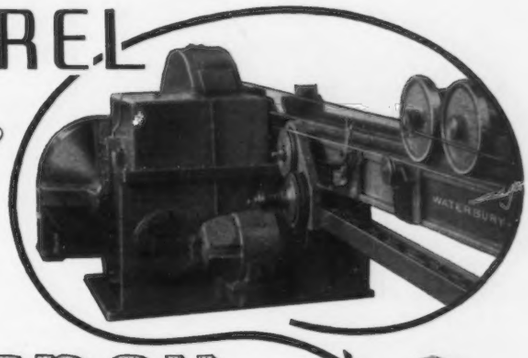
Buffalo

• • • **Production executives** of 12 manufacturers of small arms for the Army, representatives of the Ordnance Department and the office of Undersecretary of War were here last week studying machine gun production in the new $10,000,000 plant of the Buffalo Arms Corp. The delegation are members of the Small Arms Weapons Committee, an engineering advisory group. Harry A. Stevens, works manager of Colt's Patent Fire Arms Manufacturing Co., Hartford, Conn., is chairman.

Heads OPM Branch Section

• • • **Frederick Gade** has been made head of the recently created Maritime Section of the Contract Distribution Division, OPM, in New York, with offices at 122 East 42 Street.

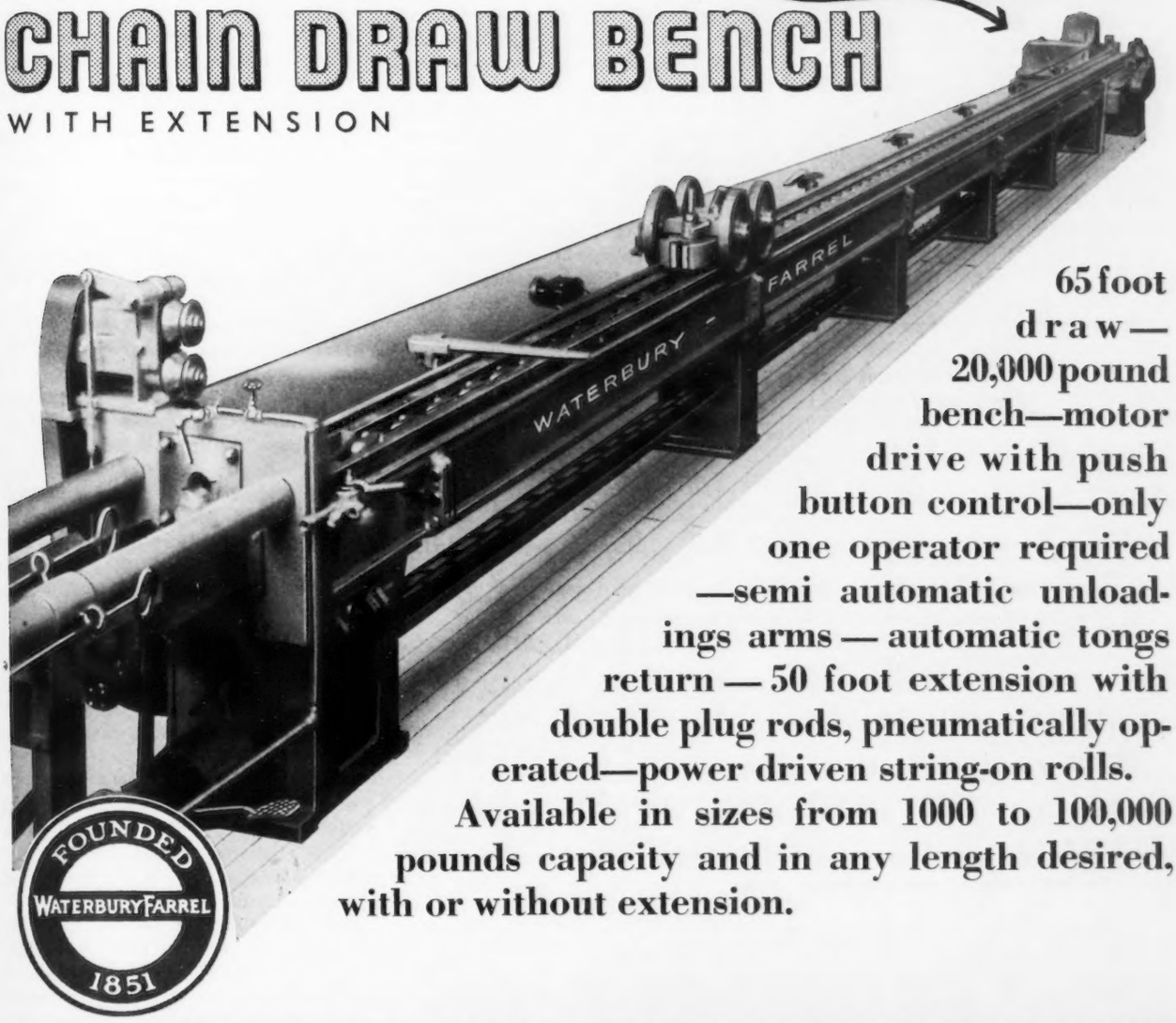
ANOTHER MEMBER *of the* WATERBURY-FARREL *Line*



The MOTOR DRIVEN

CHAIN DRAW BENCH

WITH EXTENSION



65 foot draw—20,000 pound bench—motor drive with push button control—only one operator required—semi automatic unloadings arms—automatic tongs return—50 foot extension with double plug rods, pneumatically operated—power driven string-on rolls. Available in sizes from 1000 to 100,000 pounds capacity and in any length desired, with or without extension.

FOUNDED WATERBURY FARREL 1851

MACHINERY FOR FLAT METAL, SHAPES, RODS, TUBES AND WIRE

WATERBURY FARREL
FOUNDRY & MACHINE COMPANY
WATERBURY • CONNECTICUT • U·S·A

Lack of Scrap Hits Steel Expansion Plan

Cleveland

• • • **With a shortage** of iron and steel scrap of close to 10,000,000 tons shaping up for 1942, and an insufficient supply of this material expected to be available for 1943 and 1944, it appears that Federal plans to expand our steel-making facilities will merely increase our idle steel capacity, according to a survey completed by THE IRON AGE with the cooperation of responsible steel, iron, and scrap authorities. Scrap dealers and steel mill men have been called to Washington to consider ways and means of increasing or speeding up the flow of scrap to mills, while the Bureau of Industrial Conservation for the OPM has launched a drive for the salvaging of scrap metals that will soon spread to national proportions. But if the steel industry cannot be assured of a larger supply of scrap for the next three years, Washington might just as well abandon its steel expansion plans, unless the new plants are intended and fully expected to remain idle for want of raw materials.

The basis for the study was the experience for the 1936-40 years inclusive, when some 261,671,000 net tons of steel were produced in our openhearths, Bessemers, and electric furnaces from raw materials including 149,214,000 net tons of pig iron, 63,923,000 net tons of purchased scrap, and 77,691,000 net tons of home scrap. This means that only 85.7 per cent of all the pig iron consumed in both steel mills and foundries during those years went into steel-making, and that only 73.2 per cent of the purchased scrap consumed went to steel furnaces. Moreover, the tonnage of home scrap consumed during this base period averaged 29.7 per cent of the tonnage of steel produced.

Applying this experience to 1942, the survey reveals that out of the probable output of 58,049,000 net tons of pig iron, only 49,748,000 net tons, or 85.7 per cent, will go to steel furnaces. At the same time, with scrap authorities estimating that only about 21,000,000 net tons of purchased scrap will be available to steel mills and foundries, it is conservatively figured that the mills might get 15,372,000 net tons, or 73.2 per cent of the outside scrap available. Since the total amount of pig iron and purchased scrap consumed during the 1936-40 period was 122.8 per cent of the amount of steel produced, on the same basis we would find that only about 80,000,000 net tons of steel could be produced in 1942. This would yield some 23,750,000 net tons of home scrap, on the basis of the 29.7 per cent ratio explained above. A geometrical formula checks with this as closely as 23,766,000 net tons, or a difference of only 16,000 net tons.

Approaching the theory of how much steel can be produced from another standpoint, we may total the amount of pig iron available for the industry, the amount of purchased scrap expected to be on hand, and the fairly accurate estimate of how much home scrap will be returned, to find that there will be 88,870,000 tons of these raw materials that will be fed to the steel furnaces next year. Of this, an average yield of 90 per cent (which checks with the base period experience) would mean a steel production of 79,983,000 net tons for 1942. Obviously, the 80,000,000 net tons round figure is close enough for use.

Yet, it is estimated that our steel-making facilities would turn out 89,000,000 net tons, if they could be maintained at 100 per cent of capacity. As a result, we may expect our steel operations to average 90 per cent of capacity next year due to a scrap shortage, and that 9,000,000 tons of our steel capacity will go unused. To make use of these facilities, our steel-making experience indicated that 10,000,000 net tons of additional purchased scrap will be needed for our steel mills.

This gloomy conclusion is the result of a careful consideration of whether or not pig iron output can be pushed higher than the

How Much Scrap Will We Need?

CONSUMPTION OF IRON AND SCRAP IN STEEL-MAKING AND STEEL OUTPUT FROM 1936 TO 1940 (NET TONS)
(000's omitted)

Material Consumed	1936	1937	1938	1939	1940	5-Year Totals
Purchased Scrap	14,745	14,967	7,994	12,136	14,081	63,923
Home Scrap	16,371	16,807	9,544	15,289	19,680	77,691
Pig Iron	28,694	32,313	17,574	30,460	40,173	149,214
Total Materials	59,810	64,087	35,112	57,885	73,934	290,828
Steel Produced	53,500	56,637	31,752	52,799	66,983	261,671

Average experience indicated by these figures:

(Formula 1)
Amount of Steel Produced 1936-40, 261,671,000 equals 90% of Total Materials Consumed (290,828,000).

(Formula 2)
Home Scrap Consumed, 77,691,000, equals 29.7% of Steel Produced (261,671,000).

(Formula 3)
Steel Production equals 122.8% of Pig Iron and Purchased Scrap Consumed, or 261,671,000 equals 122.8% of (149,214,000 plus 63,923,000) 213,137,000.

PURCHASED SCRAP CONSUMED IN FURNACES AND FOUNDRIES
(Net Tons — 000's omitted)

Consumed	1936	1937	1938	1939	1940	Total
In Steel-making only	14,745	14,967	7,994	12,136	14,081	63,923
In all furnaces and foundries	19,552	20,311	11,226	16,705	19,482	87,276

(Formula 4)
About 73.2% of total scrap consumed is used in steel-making.

PIG IRON CONSUMED IN FURNACES AND FOUNDRIES
(Net Tons — 000's omitted)

Consumed	1936	1937	1938	1939	1940	Total
In Steel-making only	28,694	32,313	17,574	30,460	40,173	149,214
In all furnaces and foundries	33,710	38,143	20,725	35,233	46,186	173,997

(Formula 5)
About 85.7% of total iron produced goes into steel-making.

3-Year Projection

BASED ON 1936-1940 EXPERIENCE

	1942	1943	1944	
Potential pig iron output at 98% capacity	58,049,000	64,038,000	64,397,000	
Approximate amount available for steel-making 85.7% (Formula 5)	49,748,000	54,881,000	55,188,000	(A)
Estimated total "purchased" scrap available	21,000,000	21,000,000	21,000,000	
Available for steel-making 73.2% (Formula 4)	15,372,000	15,372,000	15,372,000	(B)
Total A plus B	65,120,000	70,253,000	70,560,000	
122.8% (Formula 3) equals approximate steel output	79,967,000	86,271,000	86,648,000	
Resulting home scrap (See Formula 2)	23,750,000	25,622,000	25,734,000	(C)
A plus B plus C	88,890,000	95,896,000	96,315,000	
90% of this (Formula 1) potential steel output	79,983,000	86,287,000	86,665,000	
Available output capacity	89,000,000	93,000,000	99,000,000	(X)
Idle steel capacity	9,017,000	6,713,000	12,335,000	
Scrap or iron needed	10,009,000	7,451,000	13,692,000	

(X)—If the OPM's proposal to add 10,000,000 tons of steel-making capacity to the 89,000,000 available next year goes through.

figures we have used. Reliable opinion is that the nation will be fortunate if the blast furnaces now scheduled for completion at various dates in 1942 will actually be finished on time. Hampered by a bottleneck in turbo-blowers, the availability of new blast furnaces next year may actually be less favorable than indicated here, so that our idle steel-making plant in 1942 may be more than our conservative 10 per cent estimate.

With circumstances blocking an increase in blast-furnace capacity sufficient to offset in pig iron the indicated 10,000,000 ton shortage of raw materials for next year, and the ratio of home scrap dependent entirely upon the amount of steel produced, the only possible "out" is the collection of 10,000,000 additional tons of scrap by dealers in 1942 over the estimated 21,000,000 tons available next year.

Realizing the seriousness of the scrap picture, steel mills and foundries have taken drastic steps to secure this raw material, such as trucking their scrap purchases over long distances, arranging to have plant scrap returned from customers, and relaxing on inspections of scrap purchases. The OPM has been actively allocating shipments of scrap to steel plants working on defense orders, such as Republic's Youngstown mill and that of Sharon Steel. Yet, openhearths are now idle at Lackawanna, Youngstown and other points, and this is said to be only the beginning of shut-downs because of insufficient scrap.

Observers with experience ranging back to the last World War have offered a number of suggestions to THE IRON AGE toward the breaking of this bottleneck. The OPM's salvage drive, launched Dec. 9, might be more effective if the WPA or the CCC in various areas were harnessed to collect small odds and ends from homes and farms. Another step worthy of consideration would be the organized transportation of old autos from the isolated yards of second-hand dealers, who have no equipment for preparing this potential scrap. These used parts dealers would not be entirely divested of the many old cars that constitute their parts inventory, and would be paid the scrap value for the autos taken to the junk dealers' yard, with the Government subsidizing the transportation cost. Federally supervised or sponsored collection might also be made of potential scrap in old or partly destroyed plants, cannons in public squares, heavy iron railings, unused railroad spurs, etc. Owners of the scrap so recovered would be suitably reimbursed, or substitute fences, etc., could be supplied temporarily out of nonscarce materials. Perhaps a Federal drive in Latin America might yield a large amount of scrap.

Present price ceilings on scrap do not make most of the potential scrap mentioned available, since collection costs are too high. Moreover, scrap dealers complain that many owners of unprepared scrap demand the publicized OPA ceiling prices without making allowances for collection, transportation, and preparation costs incurred by the dealers. Strangely enough, the theory of freezing prices on scrap was not disputed by any observers consulted by THE IRON AGE, but the question posed by several informed executives is: Doesn't the insufficiency of the scrap being collected at present OPA price ceilings indicate that the "frozen" levels are too low?

Unless the purchased scrap problem is solved, the accompanying tables indicate that our shortages for the next three years will be 10,009,000 tons in 1942, 7,451,000 tons in 1943, and 13,692,000 tons in 1944, on the basis of highly conservative calculations which make no allowance for the greatly expanded use of scrap by foundries.

OEM Detroit Branches In New Quarters

Detroit

• • • **The** Office of Emergency Management will group some of its Detroit branch offices in new permanent quarters on the eighth floor of the Boulevard Bldg., Woodward Ave. at Grand Blvd., Detroit, in the near future when the conversion of 17,000 sq. ft. of office space has been completed.

It is planned to group here the Priorities Division, Defense Contract Service, Training Within Industry, Housing Administration, and probably OPA offices. Approximately 5000 sq. ft. will be devoted to a display of parts and defense items as an aid to subcontractors or those seeking contracts.

HARTFORD BRIDGE COLLAPSE: The 95-ton central span of the new $60,000,000 bridge being erected over the Connecticut River at Hartford collapsed as it was being placed, killing six men and injuring 18 others. Among those killed was William J. Ward, who directed the erection of the Golden Gate Bridge at San Francisco.

Hope For Smaller Plants Seen In Navy, Army Pool Efforts

• • • **The Army and Navy** last week both took steps toward staving off the disintegration of hundreds of small plants due to their inability to participate in defense work. The efforts of both agencies were directed largely toward encouraging and removing obstacles in the way of the pooling of facilities of small plants.

Whether these efforts would be successful in avoiding, or even delaying, the small plant crisis is debatable, but industrial executives expressed the belief that these moves might presage the beginning of a practical effort to ease the desperate plight of small business.

The Army lent action to its words by announcing the awarding, on a competitive basis, of a contract for 102,500 fuses for antitank land mines to a group of small plants located in the New York, New Jersey area. The New York Ordnance District, which placed the contract, pointed to this as an example of how small plants may participate in defense work.

Under this pool plan it is necessary for one of the companies to act as the prime contractor to assure performance of the contract. In the case of the fuse award, the companies involved form a company known as the William Gesell Mfg. Co., to act as the prime contractor. The companies making up the pool, whose normal products range from scales to pencils, included the Eagle Pencil Co. (largest member of the pool) A. W. Franklin Co., Stewart Stamping Co., Cary Spring Co., John Chatillon & Sons, Acme Air Appliance Co., American Screw Products Corp., and several small screw machine shops.

A number of the companies receiving the fuse contract have organized the Manufacturers Defense Association, Inc., of 122 East 42nd Street, New York, to make their efforts to obtain defense work more effective. These plants are all faced with possible shutdowns due to lack of raw materials and have been seeking to participate in defense work for some time.

While it was through the efforts of members of this association that the fuse contract was obtained, on a competitive basis, Ordnance officers pointed out the contract was actually awarded to the William Gesell Mfg. Co., and not to the association. Officers of the association, however, expressed the hope that in the future they would be able to negotiate directly with the defense agencies.

The Navy department has reported that as part of its efforts to aid small business it is resurveying articles it purchases to determine where it could relax its specifications. The department is also seeking to reduce the red tape involved in selling to it.

It has, in addition, created a force of officers who will work with OPM to explain regulations and handle other details concerning Navy buying. In the past such work was done through routine channels and frequently bogged down and discouraged small businessmen seeking Navy work.

Belief that action might be taken shortly on the question of associations was heightened by the Navy announcement that the Department of Labor had agreed to exempt manufacturers, under certain circumstances, from various provisions of the Walsh-Healey Act.

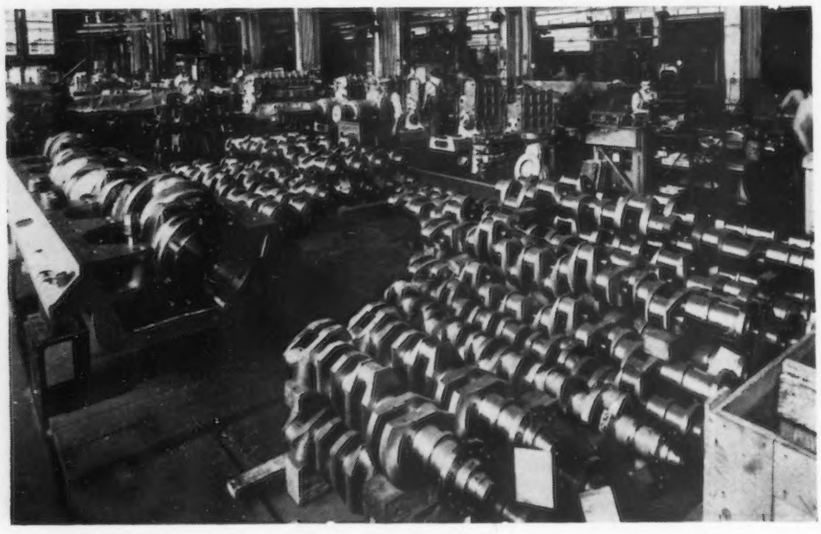
These exemptions, it was explained, will permit any defense production association (a pool of manufacturers) which is certified by the Division of Contract Distribution of OPM to contract with agencies of the United States.

It is apparent that should such a program for "defense associations" be adopted, strict surveilance will be exercised over such groups and permission to participate directly in defense work will be given only after a thorough investigation.

One of the chief obstacles to greater participation of small plants in direct defense work has been their inability to support the engineering and legal staff required to compete against larger companies for such business. By enabling the small manufacturers to pool their efforts in a membership association, the cost of such a staff can be divided among a number of plants and giving them all means of performing the required engineering and legal preparations which an individual plant could not accomplish.

The 12 companies making up the Manufacturers Defense Association who will participate in the fuse contract are the Eagle Pencil Co. (the largest member), Dollin Corp., A. W. Franklin Co., Stewart Stamping Co., Olderman Brass Foundry, Acme Air Appliance Co., Marino Spring Co., Tek Bearing Co., F. & J. Metal Products Co. and John Chatillon & Sons.

DIESELS FOR THE NAVY: Crankshafts shown below are ready for assembly into engines for the U. S. Navy. The picture was taken at the recently enlarged Cleveland Diesel Engine Division plant of General Motors Corp. at Cleveland. *Photo by Globe*

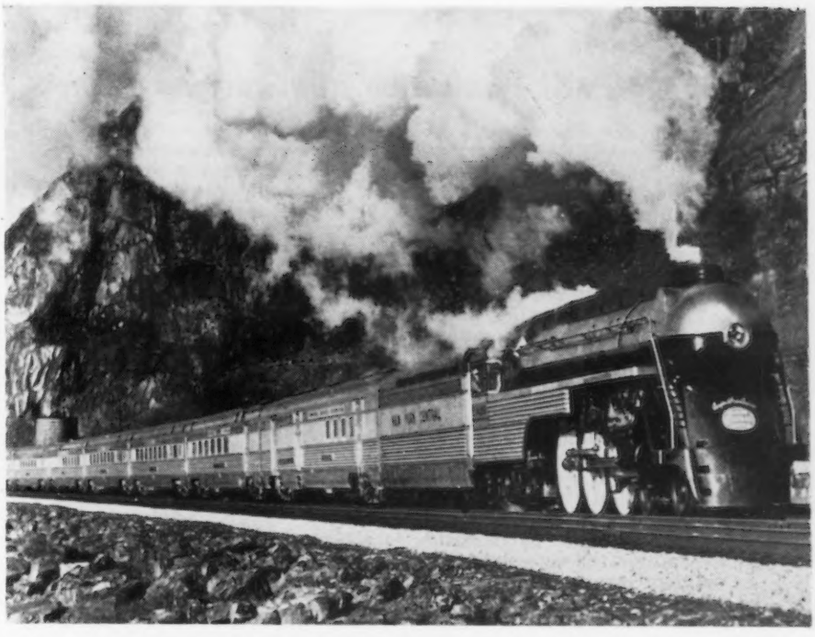


The association maintains an engineering staff, available to the members, which surveys each member's plant and which makes a cost analysis of items on which it is proposed to bid. This analysis is available to all members.

One characteristic of the association which differs from other plant pools is that it seeks not only contracts in which all members may participate, but also in contracts which only a portion of the membership may be able to work on. This, it is claimed, enlarges the possibilities of the group and gives it greater flexibility in assisting its members.

Referring to the formation of the Gesell company to act as prime contractor for the fuse contract, Mr. O'Gorman said that any reserves accumulated by the Gesell company will be pro-rated among the participating companies. "If it passes a reasonable figure, we expect to make a rebate to the government on everything above a fair profit."

It is Mr. O'Gorman's opinion that small plants organized after the pattern of the Manufacturers Defense Association, can successfully compete with large companies for war work.



"CHATTANOOGA CHOO-CHOO": This new, all coach, streamlined Empire State Express, built of stainless steel by the E. G. Budd Co., Philadelphia, for New York Central Lines, will operate between New York, Buffalo, Cleveland and Detroit.

OPM Rules on "Associations"

Washington

• • • **Commissions on** defense jobs will not be permitted in the organization of defense production associations. These associations, being organized by groups of small manufacturers in many sections of the country to seek and execute defense contracts or subcontracts which they cannot handle individually, must not be sponsored by "dubious defense promoters."

In a bulletin to 81 field offices announcing that such promoters are barred from participation in defense production associations, Floyd B. Odlum, OPM Director of the Contract Distribution Division, said that in order to protect legitimate production associations against trouble under the Federal Anti-trust laws, which forbid combinations in restraint of trade, OPM General Counsel John Lord O'Brian and Attorney General Francis Biddle agreed recently that organization plans of each proposed association must be approved in advance by OPM and the Department of Justice.

Mr. Odlum defined production associations "for present purposes" as cooperative efforts for the pooling of facilities for defense work, either under prime contracts or subcontracts by two or more manufacturing units faced with material shortages and consequent dislocation of labor and production in carrying on their normal businesses.

"Such associations might be used whenever the pooling of facilities appeared feasible in order to spread defense work and assist the more effective distribution of defense contracts among smaller business enterprises," Mr. Odlum said.

He added, however, that it was not contemplated, for example, that industry-wide trade associations would be permitted to convert themselves into defense production associations or that defense production associations would be available as a device "for horizontal organization of all or a substantial segment of the units of a particular industry seeking to augment their economical position in relation to their regular business."

Junius S. Morgan Resigns

• • • **At a meeting** of directors of United States Steel Corp. Tuesday it was announced Junius S. Morgan had resigned as a board member and as alternative member of the financial committee. The action was necessitated by Mr. Morgan's call to active duty in the Naval Reserves. He served in the World War and saw action on the English Channel. As his resignation created a third vacancy on the board, the directors reduced the board from 18 to 15 members and the finance committee from 12 to 11.

Mullins to Make 105-mm. Shells

Salem, Ohio

• • • **The Mullins Mfg. Corp.** began work on a $697,493 order for 105 mm. shell projectiles around Dec. 10, by which time some $400,000 worth of equipment sent here by the government will be installed. Owned by the government, the equipment will be used to machine rough steel forgings into finished shells. The company's present order is regarded as an "educational" one and is expected to be followed by additional defense work of this type.

Highlights of Production Requirements Plan

• • • The new Production Requirements Plan is designed to provide a broader priorities instrument to assist manufacturers get materials. At the same time it represents a partial attempt to synchronize inventories with the defense program. The new form, PD-25A, was shown on pages 96 and 97 of THE IRON AGE, Nov. 27.

OPM says it will reduce much paper work; give varying ratings consistent with the use and importance of particular products; cover more manufacturers; and will help provide material in advance of requirements better than the certificate procedure applying at present. The Defense Supplies Rating Plan, which the new procedure supplants, was restricted to manufacturers doing a certain percentage of defense work, but the new plan does not have that limitation.

The plan is intended to be used only by manufacturers. However, suppliers will benefit by it even though they do not have to file PD-25A.

The plan contemplates assistance for both defense and "essential civilian" needs. Essential civilian work is pretty much undefined but may become better classified as a result of the new reports. The definition of essential civilian work also will change from time to time on the basis of the reports filed.

The manufacturer participating in the new plan will still have to go out and get the material he needs.

Complete inventory information must be given. Inventories must be held at the minimum practicable level.

Application form PD-25A may be reproduced by anyone who wants to use it so long as it is reproduced exactly in its original form, size, color, and phraseology.

All communications and applications should be addressed to the Production Requirements Plan Section, Division of Priorities, Office of Production Management.

An applicant granted a rating under the plan serves the rating on his suppliers by a prescribed endorsement on his purchase orders.

Suppliers of the applicant may extend the rating to obtain delivery of materials which are to be physically incorporated in the applicant's products, in accordance with the terms of the preference rating order issued in connection with the plan.

No preference ratings other than those authorized in form PD-25A may be used by the producer operating under the plan to obtain deliveries of production materials or maintenance, repair, and operating supplies unless specific authorization is granted.

PD-25A calls for information on operations during the months of July, August and September, 1941.

A manufacturer making a line of capital goods and a line of consumer goods will file separate reports on each line.

For firms requiring only small amounts of a few products, the new plan is not recommended. It would be simpler for them to file PD-1 as at present.

Records supporting data reported in all sections of Form PD-25A must be available for inspection. It is understood OPM will make test checks here and there through the nation after the plan goes into operation.

Five copies of Form PD-25A must be submitted. The original copy must be certified by an official duly authorized for such purpose.

Steel Warehouse Priorities Clinic at New York, Dec. 19

Washington

• • • **A priorities clinic** for steel warehouse operators in New York and vicinity will be held in the grand ballroom of the Hotel Astor at 2 p.m., Dec. 19 when J. R. Stuart, head of OPM's Warehouse Section, Iron and Steel Branch, and two assistants will answer questions submitted in advance or asked from the floor. Invitations for the meeting have been sent out by the Steel Distributors Institute of New York, the American Steel Warehouse Association and the National Association of Sheet Metal Distributors.

A supplement to OPM order M-39 issued last Friday relieved users of cobalt who require less than 50-lb. a month of the necessity of filing monthly request forms. The purpose of the order, it was stated, is to relieve small consumers, principally in the chemical field, of the burden of constant reporting.

The Director of Priorities said that all other provisions of the order remain in effect. Users of cobalt were warned that attempts at evasion would result in revocation of the exemption.

Manufacturers who are making armored half-track vehicles for the Army and for the British last Friday were granted the assistance of an A-1-f preference rating in a limited blanket rating order. The rating assigned by the order, P-35, may be applied to the acquisition of material which will be physically incorporated in the finished vehicle.

Refrigerator Quota Cut For January, February

Washington

• • • **Mechanical refrigerator** makers were ordered Dec. 4 by OPM to cut production 40.6 per cent during January and February with two alternate base periods. Cuts during the two months will range from 30 to 52 per cent dependent upon the size of each company. The original limitation of Sept. 30 reduced output for the five months ending Dec. 1941, 37 per cent below average monthly sales for the year preceding July, 1941, but was inadequate to reach the desired diminished level of 2,007,000 units set for the 1941-42 year beginning with Aug. 1941.

The first base period is identical with the one established in the original order, a percentage of the average monthly sales for the year ending June 30, 1941. The second base period is arrived at by taking the average of the percentage of a single firm's sales during each of the fiscal years ended June 30, 1939-40-41 and applying it to the total industry sales during the year ended June 30, 1941.

Class A companies, whose average monthly sales were 16,000 units or more are limited to 48 per cent production during January and February; Class B companies, whose sales ranged from 5000 to 16,000 units, 60 per cent; Class C companies whose sales were less than 5000 units, 70 per cent production for the base period.

A system was also established under the extension to permit companies to borrow from their January and February quotas in order to keep operation at a fairly high level during the remainder of the year.

Revisions for The Iron Age Priorities Guide

• • • **Following revisions should be made to the Allocations and Priority Guide published with issue of Nov. 27.**

Under "P-Orders," pages 3 and 4, add:

P-56—Amendment (12-2). Ratings extended to foundries and machine shops operating in mining areas.

P-65—Material for marine paints (12-5). Related form: PD-82.

P-85—Material for resistance welding electrodes (12-3). Related forms: Pd- PD-81, PD-81-a, PD-82.

Under "L Orders," page 4, add:

L-5-a—Mechanical refrigerator production schedule for January and February, 1942. (12-4).

Under "OPA Price Ceilings," page 5, add:

No. 45—Asphalt and tarred roofing products (11-29).

No. 46—Relaying rails (12-2).

Under "Forms to Use," page 6, add:

PD-170—Manufacturers' monthly report on vacuum cleaner production, re: L-18.

PD-171—Manufacturers' quarterly report on vacuum cleaner production, re: L-18.

Trailer Limitations Removed

Washington

• • • **Limitations on the** production of heavy truck trailers and bodies and cabs for medium motor trucks were withdrawn Dec. 4 by OPM. Order L-1-a restricting September-December production to no more than two-thirds of truck trailers of over five tons capacity made during the first half of 1941, was said to be unwise by the Division of Civilian Supply since trailers of this kind have proved the most economical form of commercial highway transportation both as to cost and metals consumed. Curtailment of the making of bodies and cabs for medium motor trucks was described as unnecessary since the limitation on medium trucks would govern such manufacture.

THIS WEEK'S Prices and Priorities

High speed steel orders taken in any one quarter must consist of at least 75 per cent molybdenum type and not more than 25 per cent tungsten type, according to amendment to Order M-14 issued Nov. 29. Previous ratio was 50-50. (OPM:T77)

Copper production and how to increase it will be subject of public OPM hearings scheduled to be held shortly. (SPAB:SPA19)

Asphalt and tarred roofing products placed under ceilings in schedule No. 45 to become effective Dec. 12. (OPA:PM1675)

Ethyl alcohol Order M-30 extended indefinitely in amendment issued Nov. 29. (OPM:PM1679)

Salvaging campaign covering wastepaper, rags, scrap metal and rubber to be tested in Maryland. (OPM:PM1677)

Foundries and machine shops in mining areas extended assistance of priorities for repair and operation material in amendment to Order P-56 issued Dec. 2. (OPM:PM1685)

Shoe machinery makers asked to attend meeting with OPA on Dec. 10 to discuss price situation. (OPA:T10)

Tinplate to be made available to Latin-American countries. (SPAB: SPA17)

Mechanical refrigerator production to be further curtailed in January and February by Order L-5-a issued Dec. 4. Cuts ranged from 30 to 52 per cent. (OPM:PM1695)

Medium motor truck and passenger carrier makers may exclude from OPM production quotas all vehicles sold to Army, Navy, other specified government agencies and foreign countries, according to interpretation No. 1 or Order L-1-a (OPM:T80). All restrictions on output of truck trailers removed in amendment to Order L-1-a. (OPM:PM1694)

Relaying rails placed under a formal price ceiling or in schedule No. 46 issued Dec. 2. (OPM:PM1687)

Tin can makers asked to add grapefruit and grapefruit juice to list of products put up in thin tin plate cans. (OPM:T83)

Resistance welding electrode makers given rating of A-1-c for supplies in Order P-85 issued Dec. 3. (OPM:T74)

Textile mill requirements of cones, tubes and spools included under terms of Order P-53 in amendment issued Dec. 3. (OPM:T75)

Western pine lumber price ceiling to be discussed Dec. 8 with OPA. (OPA:PM1692)

Preference orders extended: P-33 to Feb. 14, 1942; P-8, P-20, P-21 to Dec. 31, 1942. (OPM: T71 and T72)

Farm machinery and equipment rating changed from B-1 to A-8 in amendment to Order P-33 issued Nov. 29.

Bakery goods producers, both wholesale and retail, may use A-10 rating of order P-22, according to interpretation No. 3 issued Dec. 5. (OPM:T79)

Cobalt consumers using less than 50 lb. monthly do not have to file request forms under order M-39. (OPM:T81)

Armored half-track vehicles makers granted rating of A-1-f under order P-35. (OPM:PM1706)

Marine paint manufacturers given rating of A-3 by order P-65 to acquire materials. (OPM:T78)

Power plant construction, public and private, to be given all aid in completing projects under construction, SPAB rules, but new construction to be discouraged except when essential to defense. (SPAB:SPA20)

Scrap price ceiling violators cited by OPA in first public statement giving names of persons and companies involved. (OPA:PM1715)

• • •

For copies of above announcements address defense agency concerned, at Washington, giving announcement number as shown in parentheses after each paragraph. (For example, **OPM:PM1500** *means announcement* **1500** *issued by Office of Production Management).*

First Heavy Tank Is Portable Fort

Eddystone, Pa.

• • • **The United States'** first heavy tank designed for high volume production was delivered to the Army here Monday by the Baldwin Locomotive Works, marking another important contribution by Baldwin to the defense program.

This 57-ton land battleship, designated as the M-1, incorporates many design advantages lacking in the M-3 medium tank. Notable in this respect is the full revolving turret which carries a 75 mm. cannon, a shield for the suspension unit, very few flat surfaces and a squat silhouette.

Practically speaking, the new M-1 is a portable fort. Its armor is substantially heavier than the medium tank and its full sized 75 mm. cannon undoubtedly has greater effectiveness.

In addition to the 75 mm. cannon in the turret, the M-1 carries a 37 mm. cannon and a number of .50 and .30 cal. machine guns.

The mounting of the 75 in a turret is probably one of the outstanding features of the new heavy tank. This power driven turret can be swung a full 360 deg., and, in addition, the gun can move vertically within fairly wide limits.

The suspension mechanism on the heavy tank is protected by a skirt of rolled armor that will probably resist the heaviest machine gun fire.

The hull of the M-1 is a one-piece casting, as is the turret. Most of its lines are rounded or sloping, presenting a minimum of flat area to opposing fire.

The M-1 is surprisingly agile, considering its weight and size, although obviously it is not as fast nor as maneuverable as the medium tank. The M-1's tracks are all metal, except for rubber inserts on the inside section. The heavy tank does not run on rubber tracks, as does the medium tank.

While unofficial comment of Army officers suggested that sufficient experience has not been available to determine the full tactical potentialities of the heavy tanks, they may well develop into effective weapons for use in breaking up medium and light tank attacks and as offensive spearheads.

It is understood the ammunition carrying capacity of this heavy tank is substantially greater than those of the medium type. A crew of six to seven is required to operate the new heavy tank. Baldwin has been given a contract totaling $5,689,725 for 50 tanks. The average cost of each tank is expected to be around $115,000.

Acceptance of the tank took place in an atmosphere sobered by the developments in the Far East over the week-end and added significance to the words of William H. Harmon, vice-president of Baldwin, who, in delivering the tank to the Army, pledged his company to the limit of its facilities.

NEW LAND BATTLESHIP: Heavily armored and carrying a full-sized 75 mm. cannon, the Army's new heavy (57-ton) tank is described by ordnance officials as the most powerful fighting tank in the world. Designers, learning from experience of British and own observers, have eliminated in this model many objections found in the medium tank. The first heavy tank was delivered to Army on Monday by Baldwin Locomotive Works.

Customers Requested to Return Steel Drums Promptly

• • • **Eagle-Picher Sales Co.** on Dec. 4 asked its customers promptly to handle and return steel drums in which lead oxide is shipped. "We are in the future going to retain title to the drums," the company said, "and after they have served your purpose, they are to be returned to their original shipping point."

150 Locomotives Ordered

• • • **Orders** have been placed by the United States War Department for an additional 150 steam locomotives for export under lend-lease provisions. The new orders, as in the case of 50 locomotives ordered previously, were divided among Baldwin Locomotive Works, American Locomotive Co. and Lima Locomotive Works.

Magor to Build Burma Cars

• • • **Magor Car Corp.** has announced receipt of an order for 230 specially designed freight cars for use on the railroad being built under lend-lease provisions to carry supplies to the Burma Road. The cars are of narrow gage and range from 20 to 30 metric tons in capacity. Delivery is to start in 100 days.

Policy Groups Being Assembled in Steel For Consulting Aid

Pittsburgh

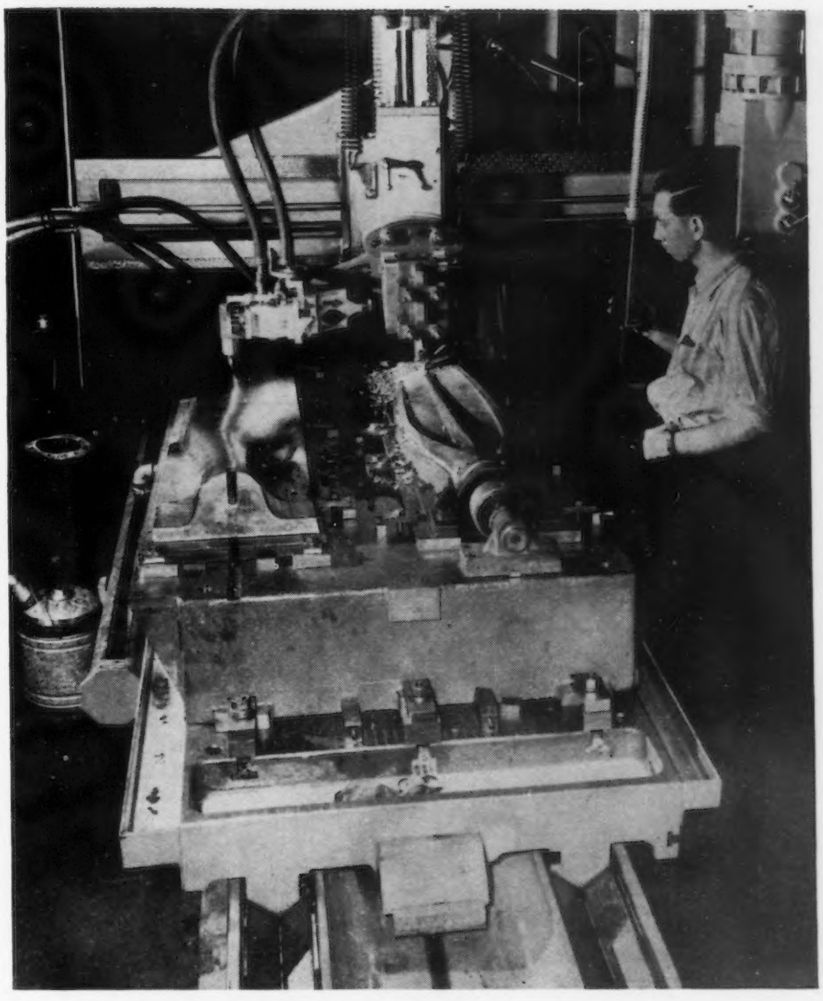
• • • **Some form of** policy committee comprised of experienced steel men who may become part of the carbon steel group of the iron and steel branch of OPM, is in the making, according to reports reaching THE IRON AGE.

It is understood that such a committee would act in a consulting capacity so that the various questions of priorities and allocations for various steel products may become more coordinated than has been the case in the past. It is said that the seriousness of the all-out production for defense, coupled with the imposition of mandatory allocation on some steel products, has brought about a further need for complete and experienced coordination so that no loss in steel production will materialize because of the gigantic task ahead.

Unofficially, it is understood that the following steel executives have been mentioned in connection with the committee of consultants—J. H. McKown, U. S. Steel Corp. of Delaware as possible chairman of the committee, M. W. Cole, Bethlehem Steel Co., consultant on plates and shapes; Norman W. Foy, consultant of alloy steels; William G. Hume, Pittsburgh Steel Co., rod, wire, wire product, and cold finished bar consultant; Arthur A. Wagner, Jones & Laughlin Steel Corp., consultant on semi-finished steel; George G. Gries, Great Lakes Steel Corp., consultant on hot rolled bars.

It is also understood that Daniel F. Lacy will join the committee as consultant on pipe; L. F. Miller will become sheet and strip consultant, and G. F. Hocker will be consultant on steel castings. These men are now in the carbon steel group.

The official content of such a committee, if it is formed, will probably be announced in the near future and may include some or all of the men mentioned above.



GM'S NEW PROPELLER PLANT: A new type of hydraulic propeller is being made here at the Aeroproducts Division of General Motors near Dayton, Ohio. This machine is planing the camber side of the new airscrew for the U. S. Army Air Corps.

Seizure of Stocks Procedure Mapped

Washington

• • • **Marking the** initial exercise of war time powers, SPAB on Tuesday set up a procedure for the seizure or requisitioning of stock piles of critical defense materials. So far reaching are the regulations that they pertain to all materials entering into the production of munitions, military equipment, supplies and component parts, including machinery and tools necessary for manufacturing, servicing or operation.

This action was taken under executive order sanctioned by an Emergency Act of Oct. 16, 1941. This law empowered the President to requisition critical materials, machinery and tools necessary to prosecute war.

L. G. Martin, chief of priority enforcement and compliance section, will be responsible to Priorities Director Donald M. Nelson and will have charge of all requisitioning approvals. E. A. Tupper, former coordinator of industrial commodities of OPM'S research and statistics section, will be directly in charge of operation of the plan.

Compensation for materials taken will be fixed by the requisitioning agency, and if the owner disagrees, he will be given 50 per cent of the value fixed by the government. He may then make an administrative appeal, which if unsuccessful, may be carried to the federal district courts, or the court of claims.

Contract Train in East Yields Ideas At Every Station

• • • **Despite all that** has been printed and said, an amazing amount of misunderstanding exists concerning defense production requirements and the procedure for getting into the picture, according to contract officials on the special defense train which has been touring the East. Over 8000 individuals representing 4900 firms had come aboard the special by last week.

Some of the simplest ideas have never occurred to many manufacturers. On the other hand, the tour is serving to awaken contract officials to excellent production facilities existent in smaller communities.

As a "last resort" because their raw materials were dwindling, two partners in a shoe machinery firm visited the train at Lynn, Mass., and discovered a spindle which was almost identical with one made in their own plant. Their production cost was close to the price in a government plant. Officials contacted Washington and the two partners were told to go to Newport next day to negotiate a contract.

At Meriden, Conn., the Brooklyn Thermometer Co. was facing a shortage of brass, mercury, etc. It makes various types of thermometers and meteorological instruments. The Signal Corps has a large demand for this type of equipment but a limited supply. The manufacturer was anxious to engage in government work but did not know which branches needed the equipment. He was referred to the Philadelphia Signal Corps Procurement District to be put on the bidders' list.

At Bridgeport, Warren Matthews, of Winsted, Conn., was referred to Lt. Commander R. C. Peardon, who is on the train. Matthews represented (1) the Union Pin Co., (2) the Winsted Tool Co., and (3) a machine shop in that city. Peardon suggested that with its faclities for making common pins, the pin company might turn to producing Navy needles and wire work on Navy parachutes; that the tool company could turn out the "saddle base" (a heavy aluminum base) on the launching car operated with the airplane catapault on battle wagons. Peardon also suggested the tool company might turn out snap buckle assemblies and that the machine shop might turn out trap forgings. Matthews was referred to the Naval aircraft factory at the Philadelphia Navy Yard, Philadelphia, on these items and probably has contacted the Aviation Supply officer there by this time.

P. M. Hale, of the Taylor-Hall Welding Corp., at Springfield was steered to the designing and developing of two spot welding machines due to the recent development of incendiary bombs by the Chemical Warfare Service.

Revival of a trade which has fallen off in late years is expected to result from the visit of a group of labor organization representatives who came aboard at Bridge-

MILLSOP PRINTS ARE FIRST: Finger prints and photographs of Thomas E. Millsop, president of Weirton Steel Co., were the first to be taken in an organization-wide identification drive, recommended by the War Department. All employees will be identified.

port. They learned that skilled hand-polishers are in great demand to finish various items used in defense production. To break the bottleneck, they plan to contact the Polishers, Buffers, Platers, and Helpers International Union headquarters, to learn in what localities workers can be found in the Bridgeport area. These men were employed before the trade declined some 15 years ago but have drifted to other lines of work. With this information the labor representatives propose to locate the one-time polishers and swing them into defense training courses and then into plants where polishers are urgently needed.

Teaming up together looked practical to a Maine group from Oakland Center where axes are made in quantity. A whole community of manufacturers boarded the train—heads of five edged tool plants and one machine shop and a foundry. They had been making axes and other tools for the government, two or three of the smaller axe companies merging to handle the work better. They now have in mind a further merger to bring in the machine shop on the basis of "we thought we could get together and make a community business."

Two young mechanics, brothers, from Princeton, Mass., came aboard at Worcester in their work clothes and after telling Lt. Commander Peardon what they had in their two-man machine shop, left the train, figuring on bidding on pins used by the Ordnance Branch in making parts for small ammunition.

At Lynn, Mass., a manufacturer with several fine screw machines and a manufacturer of small metal stampings were brought together by the possibility of cooperating in the making of much-needed

rical instruments for the Sig- Corps and other branches of the Army.

Women also have a place in national defense work. For example, the widow of the former proprietor of the C. M. White Iron Works, Boston. This is principally an ornamental iron works which has a very small staff but is in a position to put on additional help if sufficient orders can be obtained. This firm, according to K. B. Dahlerup, Naval Architect, and Maritime Commission representative on the train, has made rattan tenders for the Navy Department as sub contractors for the Bailey Basket Co. This item is part of all ships' equipment on Maritime Commission vessels. It was suggested that this firm contact ship yards and ship chandlers in connection with this equipment and also on scrapers and fly-edged tools which are required.

A manufacturer near Bridgeport making kitchen gadgets for the 5 & 10 cent store trade and faced with a shutdown due to the scarcity of metal was found to be capable of making screw machine components of small arms ammunition. Within 20 minutes, while he was still on the train, another Bridgeport manufacturer was contacted who had the equipment to make "primer tubes" but was searching for a sub-contractor to do the screw machine parts. The two men were brought together and they are now in a position to submit bids on prime contracts on this item.

Peardon may be credited with starting a whole new industry in this country. A man came aboard who said he could spin fine silver wire. Peardon asked him if he could do the gold braid such as is worn on officers' sleeves or fabricate the design on Navy hats. It had never occurred to the man that this was a possible outlet for his work. These designs and this braid have been made exclusively in France. The officers prefer them to the stamped metal designs which are now being issued.

The outcome was that the man who said he could make the metal wire was sent to see a Providence man who services the jewelry trade in gold sheet. After contacting him he proposed to get in touch with a number of idle embroidery workers and turn out the designs hitherto made in France.

Shortages Cause Layoffs Even in Defense Firms

• • • **Layoffs of skilled labor,** due to lack of materials and failure to get priorities, even in defense industries, is overshadowing skilled labor shortages in metropolitan New York, says Milton O. Loysen, director of the state Division of Placement and Unemployment Insurance. Figures which Mr. Loysen says actually underestimate the situation, indicate that 75 out of 500 firms doing defense work expect or have made layoffs. The largest number of layoffs, about 1200, is expected in the iron and steel industry, close to that in machinery manufacture, and about 200 in nonferrous metal industries.

Approximately 300 firms, employing 55,000 workers, have reported materials shortages to the Division, with steel, brass, aluminum and copper most in demand.

New Coke Oven Battery Producing for T. C. I.

Birmingham, Ala.

• • • **Tennessee Coal, Iron & Railroad Co.** has begun production on a new battery of coke ovens recently completed at the by-product coke department of Fairfield steel works.

The new battery has 73 by-product ovens. Construction was started on January 23, 1941, and the capacity of the new ovens will be approximately 425,000 net tons of coke per year.

Building Contracts Gain

Buffalo

• • • **Construction** contracts awarded in upstate New York during the first ten months of this year called for materials and labor amounting to $145,075,000, an increase of 63 per cent from the $89,284,000 total in the same period last year. Projects connected with the defense program accounted for more than $55,000,000 of the 10-month total.

Name OPM Committee Member for Industry

• • • **R. B. Jenkins** of the Briggs Mfg. Co., Detroit, has been appointed as a member of OPM's Plumbing and Heating Advisory Committee.

U. S. Has Year's Supply Of Tin and Rubber

• • • **The flow of** tin, rubber, chromite and tungsten to the United States will be more uncertain than ever, now that Japan has launched her long-planned attack. Within a few hours after war broke out, Donald Nelson, director of SPAB, appealed for conservation of existing supplies.

This country has about a year's supply of rubber on hand. About 97 per cent comes from the Far East, through Singapore. Facilities for producing synthetic rubber are being enlarged in the United States, and undoubtedly will be expanded further.

Chromite in normal times is supplied this country by Africa, which furnishes 43 per cent of United States needs; the Philippines, which furnish 24 per cent; Turkey, 11 per cent; Cuba, 8 per cent, and New Caledonia, 6 per cent. Requirements next year are estimated at 860,000 tons, of which 500,000 will be for metallurgical purposes. Before Japan attacked, it was believed 900,000 tons could be brought into this country, but with sea lanes now jeopardized the picture has changed.

China has been supplying most of the tungsten used in the United States, but in calculations for next year, domestic production and South America were counted on for our needs. Some comes from Australia and 4 per cent from Thailand and Burma. Requirements next year are estimated at 21,000 tons, but may be increased due to emphasis on munitions production. A few weeks ago authorities said the supply of tungsten would be 22,000 tons next year, including 5,000 tons from China and domestic production of 8,000 tons.

At least a year's supply of tin is on hand in the United States. The Metals Reserve Corp. reported Oct. 22 that 40,392 tons were on hand and 2500 tons afloat, while 143,108 tons were on order. In addition, the Navy has tin piles and the procurement division of the government has a pile, while individual consumers have many months' supply. Conservation of tin for can making purposes has been inaugurated. Can needs are expected to rise sharply as a result of the latest war action.

Most tin comes through Singapore and the Dutch East Indies. The Belgian Congo, Bolivia and Nigeria also contribute to our needs.

The Philippines, India and Africa are suppliers of manganese ore, and were counted on next year for 600,000 tons. Production in this country is heavy and Brazil, Chile and Cuba contribute to our needs.

Statement Filed for Kearney & Trecker Issue

• • • **A registration** statement covering 198,083 shares of Kearney & Trecker Corp., West Allis, Wis., one of the large manufacturers of milling machines in the United States, was filed last week with the Securities and Exchange Commission. Blyth & Co., Inc., and The Wisconsin Co. are named as head of the underwriting group and managers of a proposed public offering.

Plant Protection Data Issued By OCD

• • • Plans for plant protection should be kept as simple as possible, the Office of Civilian Defense has urged. All personnel should be organized and trained as soon as possible.

A plant defense coordinator and heads for four divisions—fire, police, medical and maintenance services — are recommended. The coordinator is responsible for developing a communication system within the plant between himself and the organized protection squads.

Arrangements for exchange of information and mutual assistance should be made between plant managers and local governmental authorities. The Office of Civilian Defense, Washington, issued a pamphlet Aug. 14 on the subject of protection of industrial plants. The booklet contains an organization chart and discusses duties of protection squads.

Lima Cast Steel Tank Delivered to Army

Cleveland

• • • The first cast steel M-4 tank will be delivered next month by the Lima Locomotive Co., Lima, to the U. S. Army, it was revealed here during a regional conference on welded tank problems, attended by some 50 ordnance officers and representatives of tank, armor plate, and welding concerns. During the conference, Major D. J. Crawford of the U. S. Ordnance Dept., reiterated previous Army statements regarding the forthcoming change-over from the riveted M-3 tank to the rivetless M-4 tank, also a 30-ton vehicle. He added that about 25 per cent of the M-4 tanks will have cast steel hulls, and 75 per cent of them will be welded. The new tank will have a 75 mm. cannon and four .30-caliber machine guns, and will require a smaller number of machine tools in the making.

Defense Parts Exhibit Open

Detroit

• • • A new temporary exhibit room of the Division of Contract Distribution is now open at Room 207, Boulevard Bldg., 7310 Woodward Avenue. Prospective subcontractors may inspect the displays from 8:30 a.m. until 5:30 p.m.

Steel Mill Upkeep Costs $305,000,000

• • • More than $305,000,000 was spent by the steel industry in 1940 for repairs and maintenance to keep its plants in efficient running order, according to the American Iron and Steel Institute. This was nearly 24 per cent more than the $247,000,000 which was spent in 1939 for similar upkeep. In 1938, such costs totaled $125,000,000.

Costs of plant upkeep last year averaged about $6.30 for each ton of finished steel produced during 1940, almost exactly the upkeep cost per ton in 1939, when both steel production and the total sum spent on repairs were substantially lower.

Upkeep absorbed approximately 8.5 cents of each dollar of sales accounted for by the steel industry in 1940.

National Steel Corp.'s Stacks Ready to Start

Pittsburgh

• • • **With the** blowing in of two new blast furnaces at Detroit and Weirton within the next few weeks, National Steel Corp. will have completed an important part of a $20,000,000 expansion program that was announced at the beginning of the year. The blast furnace portion of the program will increase National Steel Corp.'s pig iron production by more than 750,000 net tons per year.

One furnace will be placed in operation this week by Great Lakes Steel Corp. The furnace at the Weirton Co. awaits only the delivery and installation of a turbo blower, and is expected to be in production within two weeks.

Actual construction of the furnaces was completed within six months in one case and less than nine months in the other. The program also included the rebuilding of a furnace at the plant of Hanna Furnace Corp., Buffalo.

The new furnace at Great Lakes will have an annual production of about 450,000 net tons of pig iron per year. It is 105 feet high and has a hearth 27 feet, three inches in diameter. An old furnace of smaller design was dismantled to provide the site for the new installation. The Weirton furnace will have an annual capacity of approximately 400,000 tons, which will increase the plant's production of pig iron by about 50 per cent.

Machinery Output to Reach $11,000,000,000 in 1941

Washington

• • • **The value of machinery** produced in the United States during the current year is expected to reach the all-time high of $11,000,000,000, according to the Department of Commerce. This total is $4,000,000,000 in excess of the previous record in 1929.

In an article appearing in the forthcoming issue of the Department's publication, *Domestic Commerce Weekly*, it is pointed out that this estimate applies to industrial, electrical, farm, printing and office machinery, but does not include transportation equipment. Expenditures for producer's machinery during 1941 has been estimated at $9,000,000,000, leaving about $2,000,000,000 of output of machinery for purposes other than production.

The unprecedented demand for machinery for defense purposes, the article states, means that production will be restricted during the period of the emergency only by the availability of raw materials and skilled mechanics, and the physical capacity of plant equipment.

In spite of restrictive elements there can be no doubt but that the output of machinery will further expand during the coming year, it is stated. This can be accomplished, says *Domestic Commerce Weekly*, by working more shifts and longer hours, and by utilizing materials conserved by curtailed output of non-essentials.

Relaying Rail Classified And Maximum Prices Set

Washington

• • • **Dividing** relaying rail into two categories, Price Administrator Leon Henderson last week established for the first category a base price of $28 per gross ton f.o.b. any station on selling railroad at the option of the buyer for material originating from Class I railroads and Class I switching or terminal companies. If this tonnage is sold by the railroad "in track," that is, not torn up and assembled, it shall fall into the "all other" classification. When such rail is purchased by a dealer or a jobber, it may be resold at a maximum price of $30, f.o.b. shipping point.

For the second category covering all other relaying rails, obtained from all other sources, such as short lines, interurban lines and abandoned lines, the schedule set a ceiling shipping point price of $30 minus freight between the shipping and the basing point nearest in terms of transportation charges. It is provided that in no case need the shipping point price be less than $22 a gross ton. Accordingly, the delivered price shall be the shipping point price plus the actual cost of transportation to the destination point.

The following cities are designated as basing points for relaying rail of other than Class I railroad origin:

Boston; Pittsburgh; Detroit; Kansas City; Los Angeles; Philadelphia; Cleveland; Chicago; Minneapolis; San Francisco; Seattle; Buffalo; Cincinnati; St. Louis; Portland, Ore.; Norfolk, Va.; Birmingham, Ala.; Savannah, Ga.; and Houston, Tex.

A special section of the schedule deals with relaying rail sold from warehouses equipped with machinery for reconditioning. The maximum prices per 100 lb. in this section, all f.o.b. warehouse, are: $2.25 for less than five tons; $2.00 for 5 to less than 25 tons; and $1.60 for 25 tons and over. Persons desiring to operate under this special provision were required to file, on or before Dec. 10, with the OPA, a statement indicating that they operate recognized warehouses equipped with machinery for reconditioning.

Buyers of more than 100 tons of used rail were required to file with OPA within 10 days of purchase either a certificate from an established inspection bureau or an affidavit estimating the division of the purchase among relaying, rerolling and scrap qualities. OPA reserves the right to inspect and classify the rail itself.

In the case of sales of relaying rail of 25 tons or over to the ultimate consumer, the seller is required to file either a certificate by an established inspection bureau that such rail is of relaying quality or an affidavit from the consumer stating that the rail is to be used for relaying purposes.

Corrugated Steel Sheet Piling Saves Steel

Chicago

• • • **A new corrugated steel** sheet piling specifications catalog has been issued by the Caine Steel Co., Chicago, calling attention to the manner in which this product is contributing to the conservation of steel. Because of its design and unusual strength, this lightweight piling is being used successfully on jobs that formerly required products using twice as much steel, it is claimed, and considerable space is saved in transport. The publication also contains information of interest to construction men and engineers in every field.

Put Defense Under Single Agency, Plea Of N. A. M. Congress

• • • **Among the many** critical problems facing the nation today, immediate attention must be given strikes, inflation and taxes, and a way found to concentrate the defense program under a single agency, the 46th Congress of American Industry, sponsored by the National Association of Manufacturers, declared last week in New York.

At the same time the Congress advanced post-war programs for the government and industry, and speakers stressed the necessity for a united effort toward preservation of the free enterprise system.

"If defense is to be speeded up and its cost held down the existing confusion resulting from the conflicting authority and overlapping of governmental committees must be ended," the platform for the Congress declared. "There should be a single agency with a single head who has full power to supervise and guide the defense program."

Directors of the Association elected William P. Witherow, president of Blaw-Knox Co., Pittsburgh, and chairman of the N.A.M. national defense committee, as president, succeeding Walter D. Fuller.

Our system of competitive enterprise must be preserved and perpetuated, said J. Howard Pew, president of Sun Oil Co., speaking before the Congress Friday.

"If business men are to respond to pure patriotism, they must resist any effort to destroy that competitive urge in this hour of great need," he continued, after pointing out that "it would be of little comfort to defeat Hitler in war and in so doing fasten upon ourselves his system of production and his lower standards of living."

Under private enterprise operating under competition, the American standard of living has risen sharply and the percentage of

AMERICAN INDUSTRY: William P. Witherow, president of the National Association of Manufacturers, and Knudsen, director-general of the OPM, at the 46th Annual Congress of American Industry

Witherow, newly-elected president of ufacturers (right), and William S. OPM, at the opening session of the can Industry, New York.

gainfully employed in this country is greater than ever, said Mr. Pew. Hours are shorter, pay rates are higher and prices are lower.

"It is competition which inspires that attribute of the spirit which we call initiative and because it is of the spirit individual initiative is tremendously productive," said Mr. Pew.

Tremendous economic problems are certain to follow this war and practically the whole world will have to be rebuilt, said K. T. Keller, president of Chrysler Corp., who urged industry to keep its production machinery in good running order, and to take the new skills resulting from the war and transform them into more desirable and cheaper products for the public. He also told how free enterprise had raised living standards and urged that the system be preserved at all costs.

H. W. Prentis, Jr., president of Armstrong Cork Co., and C. M. Chester, chairman of General Foods Corp., were other speakers at the Friday session who stressed the danger of the crisis faced by free enterprise.

Mr. Witherow, president of Blaw-Knox Co., urged an embargo on "policies which tend to cause unnecessary irritation and harassment to all managers of industry."

"The industrial structure of the United States stands preeminent in its devotion to its obligations and its privileges to salute the flag and carry on," he concluded after citing some of the accomplishments of industry in the defense program during the past year.

Ernest T. Weir, chairman of National Steel Corp., asserted that in many ways the attitude of the national administration itself has helped foster apathy toward the national emergency. He urged industrialists to fight against each further inroad against freedom "until public opinion can at last force action for the genuine welfare of our country."

Charles R. Hook, president of

American Rolling Mill Co., described damaging effects of strikes and said "probably 90 per cent of our personal, political and industrial disputes are the result of misunderstanding or rather a lack of understanding."

"Neither men nor nations can get together and cooperate in their mutual interest until there is confidence built upon a foundation of understanding," he continued.

"Why, instead of letting the word 'compulsion' darken the air, do we not clasp hands in agreement to get the defense production job done?" Mr. Hook said. "Private matters can wait; we have all freedom to save. Real grievances held to the minimum possible where men work under pressure and strain; fancied grievances swiftly aired and blown away; and tactical grievances and strategic forays outlawed for the duration of the emergency—that is our nation's need from all elements of industry."

The Congress unanimously voiced a demand for federal legislation to control strikes after William S. Knudsen, director general of OPM, asserted "If strikes can't be stopped during a period of emergency in any other way than by law, it should stop them."

Among the eight points embodied in the anti-strike resolution were recommendations that strikes to compel adoption of closed shop agreements be prohibited during the present emergency, and that unions should be compelled to settle disputes among themselves without any work stoppages.

Leon Henderson, administrator of OPA, told the 2000 industrial leaders of America attending the 46th annual session, that the emergency price legislation passed by the House last week was doomed to failure.

In his keynote address, Mr. Fuller declared that "labor appeasement in the face of the emergency is tragic" and warned "if we can't get at the heart of this labor mess and cure the cause, let's quit emphasizing any other emergency."

Government, industry and labor must work together if the nation is to endure, said Mr. Fuller.

Floyd Odlum, director of the OPM contract distribution division, asserted that "in 1942 Amer-

ican industry, given the raw materials, has plant and labor to produce all our defense goods presently projected for the period and nearly $50 billion worth of civilian goods." The nation cannot afford to lose its very small plants, he said, urging a "life giving grant of materials to the very small concerns."

Donald M. Nelson, executive director SPAB, told the Congress that "in our present emergency it is up to the big fellow to help the little fellow," through subcontracting and in other ways.

"More than anything else today we need unity of industry and labor," he said.

Alfred P. Sloan, Jr., chairman of General Motors Corp., discussing post-war industrial conditions, asserted "there does not seem to be in sight any important single new industrial development comparable to the auto, the radio or the motion picture. But there will be available a relatively large aggregation of new methods, new materials and more efficient instruments of production."

Charles E. Wilson, president of General Electric Co., expressed confidence in the ability of industry to go forward "faster and more fruitfully than it ever has before." Concord rather than conflict ought to be the platform for 1942 and thereafter, he said.

Livingston W. Houston, chairman of Ludlow Valve Mfg. Co., urged curtailment of non-essential government spending, pointing out that $2 billion saved from non-essential spending will pay for six battleships or many other armament items.

R. E. Carpenter, executive vice-president of the Spicer Mfg. Co., which experienced a work stoppage due to a jurisdictional strike, recommended coordination of all federal labor activities under one head. He criticized "immature" labor leaders and "a one sided and totally inadequate labor law."

At a luncheon, the NAM honored a group of defense workers whose suggestions had enabled their companies to speed up production. Honor also was paid to six women, from widespread sections of the nation and representing different industries, who had contributed to defense production.

Navy Bears Brunt of War; Will Need All Nation's Help

• • • **Of the $58 billion** appropriated to Nov. 1, 1941, for rearmament, the biggest portion has been allocated for Navy purchases, about 20 per cent of the total. In addition to the huge sums being spent by the Navy, its requirements are heavily in the metals classification.

Last week the Navy revealed that it is overhauling its system for the distribution of contracts in order to help speed up production. A relaxing of specifications is being ordered wherever possible; methods of issuing first contracts will be eased for small firms; a re-survey of hundreds of articles purchased by the Navy is under way, and some procurement programs are being split to aid manufacturers in certain definite regions.

The Bureau of Supplies and Accounts is the centralized Navy purchasing agency and either procures directly or has supervision over the purchase of all materials required by the Navy, except:

The Bureau of Yards and Docks prepares schedules, opens bids, and makes contracts for public works (i.e., buildings, drydocks, etc.) involving both labor and material in construction.

The Bureau of Ordnance purchases ammunition, arms, and gun forgings.

The Judge Advocate General of the Navy, in conjunction with the Bureau of Ships, contracts for the construction of ships at private shipyards.

The Marine Corps performs all its own purchase functions.

To get on the Navy's bidder list, apply directly to the Bureau of

Supplies & Accounts, Navy Department, Washington.

The addresses of the several purchasing agencies are as follows:

Departmental Purchases

Bureau of Supplies and Accounts, Navy Department, Washington.
Bureau of Ordnance, Navy Department, Washington.
Bureau of Ships, Navy Department, Washington.
Bureau of Yards and Docks, Navy Department, Washington.

Field Purchases

Address Supply Officer, at:
Navy Yard, Portsmouth, N. H.
Navy Yard, Boston.
Navy Yard, Philadelphia.
Navy Yard, Washington.
Norfolk Navy Yard, Portsmouth, Va.
Navy Yard, Charleston, S. C.
Puget Sound Navy Yard, Bremerton, Wash.
Naval Air Station, Norfolk, Va.
Naval Air Station, Pensacola, Fla.
Naval Air Station, Corpus Christi, Texas.
Naval Air Station, North Island, San Diego, Cal.
Naval Air Station, Quonset Pt., R. I.
Naval Air Station, Lakehurst, N. J.
Naval Air Station, Anacostia Station, Washington, D. C.
Naval Air Station, Miami, Fla.
Naval Powder Factory, Indian Head, Md.
Naval Proving Ground, Dahlgren, Va.
Naval Academy, Annapolis, Md.
Naval Mine Depot, Yorktown, Va.
Naval Station, Key West, Fla.
Naval Training Station, Great Lakes, Ill.
Inshore Patrol Section Base, Tompkinsville, Staten Island, N. Y.
Naval Aircraft Factory, Navy Yard, Philadelphia.
Submarine Base, New London, Conn.
Naval Research Laboratory, Anacostia Station, Washington.

Address Officer-in-Charge, at:
Navy Purchasing Office, Newport, R. I.
Navy Purchasing Office, 90 Church Street, New York.
Navy Purchasing Office, Civic Center, San Francisco.
Navy Supply Depot, Naval Operating Base, Norfolk, Va.
Naval Supply Depot, Naval Operating Base, San Diego, Cal.

Navy Requirements

The general range of the Navy's requirements can best be presented by the following list of standard classes into which Navy supplies are segregated for accounting and storekeeping purposes:

AIRCRAFT and aircraft materials.
AUTOMOTIVE and railroad supplies.
BOILERS, engines, etc.
BOAT and ship supplies.
BOATS, life rafts, etc.
BUILDING materials.
ELECTRICAL ACCESSORIES, wiring, and illuminating devices.

• • • Sixty-five shipyards engaged in the building of steel sea-going vessels today have 383 active shipbuilding ways of 300-ft. length or more, according to a recent survey by the National Council of American Shipbuilders. When the national emergency started in mid-1940, there were only 21 private shipyards engaged in such construction with 83 ways.

Today there are 775 sea-going merchant vessels and 503 combatant and sea-going auxiliary naval vessels under construction in privately-owned shipyards of America, the Council said.

Building time required on merchant vessels has been cut sharply. One vessel of 10,500 tons deadweight was recently completed in 6½ months. Formerly it took 10 months to a year to build a vessel of comparable size.

ELECTRICAL APPLIANCES and equipment.
FIRE SURFACING and heat insulating materials; foundry apparatus.
FURNITURE
HAND TOOLS.
HARDWARE—general.
INSTRUMENTS of precision, including accessories, outfits and spare parts.
IRON and STEEL.
LIGHTING apparatus (nonelectric).
MACHINE TOOLS, accessories, outfits, and parts.
MACHINERY and equipment for Navy Yard use.
MUSICAL instruments, accessories and parts.
MESS gear and galley equipment; laundry apparatus.
NONFERROUS materials.
ORDNANCE equipment.
PLUMBING and steam fittings, bathroom accessories, valves, etc.
PUMPS
RADIO equipment, accessories, parts and supplies.
RECREATIONAL apparatus.
SHEET METAL products.
WIRE and wire rope; electric cable and wire.

There are about 60,000 items of supplies and equipment in common use by the Navy. These are practically all listed in the Navy Standard Stock Catalog.

Federal Specifications

All Federal Specifications are sold by the Superintendent of Documents. See Price List 75, issued by the Superintendent of Documents, Washington, to whom applications for the price list and orders for items covered thereby should be addressed.

Navy Specifications

Navy Specifications are available for issue to contractors and prospective contractors only. They may be procured gratis from the Bureau of Supplies and Accounts or Navy purchasing activity issuing invitations to bid.

List of Private Shipyards Building Vessels for the United States Navy

Albina Engine & Machinery Works, Inc., Portland, Oregon.
American Car & Foundry Co., Wilmington, Delaware.
American Cruiser Co., Detroit, Mich.
American Shipbuilding Co., Cleveland, Ohio.
Anderson & Cristofani, San Francisco, Cal.
Annapolis Yacht Yard, Inc., Annapolis, Md.
Associated Shipbuilders, Seattle, Wash.
Astoria Marine Construction Co., Astoria, Oregon.
Basalt Rock Co., Inc., Napa, Cal.
Bath Iron Works Corp., Bath, Maine.
Bethlehem Steel Co., Fore River Plant, Quincy, Mass.; San Pedro Plant, San Pedro, Cal.; Staten Island Plant, New York, N. Y.; Union Plant, San Francisco, Cal.
Blanchard Boat Co., Seattle, Wash.
Bristol Yacht Building Co., South Bristol, Maine.
Burger Boat Co., Manitowoc, Wis.
Ira S. Bushey & Sons, Inc., Brooklyn, N. Y.
Camden Shipbuilding & Marine Ry. Co., Camden, Maine.
Charleston Shipbuilding & Dry Dock Co., Charleston, So. Carolina.
Colberg Boat Works & Stephen Bros., Stockton, Cal.
Commercial Iron Works, Portland, Oregon.
Consolidated Shipbuilding Corp., New York, N. Y.
Consolidated Steel Corp., Ltd., Orange, Texas.
Consolidated Steel Corp., Los Angeles, Cal.
Consolidated Steel Corp., Long Beach, Cal.
Cramp Shipbuilding Co., Philadelphia, Pa.
Defoe Boat & Motor Works, Bay City, Mich.
DeKom Shipbuilding Corp., Mill Basin, Brooklyn, N. Y.
Delaware Bay Shipbuilding Co., Inc., Lessburg, N. J.
Dravo Corp., Wilmington, Del.
Dravo Corp., Neville Island, Pittsburgh, Pa.
Electric Boat Co., Groton, Conn.
Electric Boat Co., Elco Works, Bayonne, N. J.

Farmers Now Are Shipbuilders With Few Weeks' Training

Washington

• • • Farmhands are being turned into shipbuilders with a few weeks' training, J. E. Schmeltzer, director of the United States Maritime Commission's construction division, last week told the Washington Society of Engineers. The shipyard of today, he said, is "purely an assembly point. Mass production in all possible instances, is now the rule in constructing ships."

The operations in one shop, he said, have been so sequenced that workers can learn their assigned tasks in a few weeks, instead of the year or more formerly required to train a proficient shipyard worker. The sections are finally assembled on the ways, often a case of merely joining them together.

Elizabeth City Shipyard, Elizabeth City, No. Carolina.
Elscot Boats, Inc. (Plant Shop City Island), Brooklyn, N. Y.
Erie Concrete & Steel Supply Co., Erie, Pa.
Federal Shipbuilding & Dry Dock Co., Kearny, N. J.
Fisher Boat Works, Detroit, Mich.
Food Machinery Corp., Dunedin, Fla.
Freeport Point Shipyard, Inc., Freeport, Long Island, N. Y.
F. L. Fulton, Antioch, Cal.
General Engineering & Dry Dock Co., Alameda, Cal.
Gibbs Gas Engine Co. of Florida, Jacksonville, Fla.
Gingras Boat Works, Cocoa, Fla.
Goodyear Tire & Rubber Co., Akron, Ohio.
Henry C. Grebe & Co., Chicago, Ill.
Greenport Basin & Construction Co., Greenport, Long Island, N. Y.
Gulf Shipbuilding Corp. (Plant Shop Chickasaw), Mobile, Ala.
Harbor Boat Building Co., Terminal Island, Cal.
Herreshoff Manufacturing Co., Bristol, R. I.
Higgins Industries, Inc., New Orleans, La.
C. Hiltebrant Dry Dock Co., Kingston, N. Y.
Hodgdon Bros. & Goudy & Stevens, East Boothbay, Maine.
Hutchinson Boat Works, Inc., Alexandria Bay, N. Y.
Ingalls Shipbuilding Corp., Pascagoula, Miss.
Robert Jacob, Inc., City Island, N. Y.
Jakobson Shipyard, Inc., Oyster Bay, Long Island, N. Y.
Jeffersonville Boat & Machine Co., Jeffersonville, Ind.
Kruse & Banks Shipbuilding Co., Inc., North Bend, Oregon.
Lake Superior Shipbuilding Co., Superior, Wis.
Lake Washington Shipyards, Houghton, Wash.
Lancaster Iron Works, Inc., Lancaster, Pa.
Al Larson Boat Shop, Inc., Terminal Island, Cal.
George Lawley & Sons, Neponset, Mass.
Leathem Smith Coal & Shipbuilding Co., Sturgeon Bay, Wis.
Los Angeles Shipbuilding & Dry Dock Corp., San Pedro, Cal.
Luders Marine Construction Co., Stamford, Conn.
Manitowoc Shipbuilding Co., Manitowoc, Wis.
Marietta Manufacturing Co., Pt. Pleasant, West Va.
H. G. Marr, Damariscotta, Maine.
J. M. Martinac Shipbuilding Corp., Tacoma, Wash.
John H. Mathis Co., Camden, N. J.
Mathis Yacht Building Co., Camden, N. J.
Matthews Co., Port Clinton, Ohio.
Miami Shipbuilding Corp., Miami, Fla.

Moore Dry Dock Co., Oakland, Cal.
Mystic Shipyard, West Mystic, Conn.
Nashville Bridge Co., Nashville, Tenn.
Nelson Boiler & Tank Co., Inc., Tacoma, Wash.
Henry B. Nevins, Inc., City Island, N. Y.
Newport News Shipbuilding & Dry Dock Co., Newport News, Va.
New York Shipbuilding Corp., Camden, N. J.
Niagara Shipbuilding Corp., Buffalo, N. Y.
Noank Shipbuilding Co., Noank, Conn.
Pacific Car & Foundry Co., Seattle, Wash.
Pacific Coast Eng. Co., Inc., Oakland, Cal.
Pacific Dry Dock & Repair Co., Oakland, Cal.
Palmer Scott & Co., Inc., New Bedford, Mass.
Penn-Jersey Corp., Camden, N. J.
Pennsylvania Shipyards, Inc., Beaumont, Texas.
Peterson Boat Works, Sturgeon Bay, Wis.
Platzer Boat Works, Houston, Texas.
Quincy Adams Yacht Yard, Inc., Quincy, Mass.
Rice Bros. Corp., East Boothbay, Maine.
E. C. Rice & Sons, Reedville, Va.
Robinson Marine Construction Co., Benton Harbor, Mich.
W. A. Robinson, Inc., Ipswich, Mass.
Donald Roebling, Clearwater, Florida.
R.T.C. Shipbuilding Corp., Camden, N. J.
Frank L. Sample, Jr., Inc., Boothbay Harbor, Maine.
San Diego Marine Construction Co., San Diego, Cal.
Savannah Machinery & Foundry Co., Savannah, Georgia.
Seabrook Yacht Corp., Seabrook, Texas.
Seattle Tacoma Shipbuilding Co., Seattle, Wash.
Simms Bros., Dorchester, Mass.
Snow Shipyards, Rockland, Maine.
South Coast Co., Newport Beach, Cal.
Southwest Boat Corp., Southwest Harbor, Maine.
Stadium Yacht Basin, Inc., Cleveland, Ohio.
Sullivan Dry Dock & Repair Co., Brooklyn, N. Y.
Tacoma Boat Building Co., Tacoma, Wash.
Tampa Shipbuilding Co., Inc., Tampa, Florida.
United Engineering Co., San Francisco, Calif.
Vinyard Shipbuilding Co., Milford, Del.
Warren Boat Yard, Inc., Warren, R. I.
Warren Fish Co., Pensacola, Florida.
Weaver Shipyards, Orange, Texas.
J. K. Welding Co., Brooklyn, N. Y.
Westergard Boat Works, Inc., Rockport, Texas.
Western Boat Building Co., Tacoma, Wash.
Western Pipe & Steel Co., San Francisco, Cal.
Wheeler Shipyards, Inc., Brooklyn, N. Y.
Willamette Iron & Steel Corp., Portland, Oregon.
Winslow Marine Ry. & Shipbuilding Co., Seattle, Wash.

Government Awards . . .

War Dept., Ordnance:

Accurate Tool Co., Newark; punches, pilots & crimpers	$2,329
Aerial Machine & Tool Corp., New York; switches	2,496
Ahlberg Bearing Co., Chicago; parts for gun carriages	6,959
Alden Supply Co., Philadelphia; rivets & screws	3,392
Allegheny Ludlum Steel Corp., Watervliet, N. Y.; tool steel	2,634
gages	2,040
Allison Co., Bridgeport, Conn.; abrasive wheels	1,100
Aluminum Co. of America, Washington; aluminum	1,280
Aluminum Seal Co., New Kensington, Pa.; aluminum detonator parts	23,665
American Automatic Electric Sales Co., Chicago; desk sets, dial monophone	1,160
American Brake Shoe & Foundry Co., American Forge Division, Chicago; ammunition	59,555
American Brass Co., Waterbury, Conn.; rod, copper	4,546
American Chain & Cable Co., Inc., American Cable Division, Wilkesbarre, Pa.; towing cables	20,666
American Chain & Cable Co., Wright Mfg. Division, York, Pa.; blocks	13,164
American Electric Supply Co., Boston; cable	1,959
American Foundry Equipment Co., Mishawaka, Ind.; parts for wheelabrator	5,280
American Locomotive Co., Railway Steel Spring Division, New York; steel springs	21,277
American Manganese Bronze Co., Philadelphia; bronze, manganese	28,964
American Safety Razor Corp., Brooklyn; shell housings	77,500
American Type Founders Co., Elizabeth, N. J.; tools & machinery	495,000
Ampco Metal, Inc., Milwaukee; welding rods	4,105
cylinders	1,539
Apex Tool & Cutter Co., Inc., Shelton, Conn.; cutters and blades	1,460
Appliance Mfg. Co., Alliance, Ohio; tripod mounts	323,380
G. R. Armstrong Mfrs. Supplies, Inc., Boston; hacksaw blades	5,443
Arter Grinding Machine Co., Worcester, Mass.; grinders	3,490
Arrow Transfer & Storage Co., Chattanooga, Tenn.; drayage & stevedore services	2,000
Athey Truss Wheel Co., Chicago; trailers	41,771
Barber-Colman Co., Machine & Small Tool Division, Rockford, Ill.; cutting tools	14,050
milling cutters	4,221
Barbour Stockwell Co., Cambridge, Mass.; castings	1,192
Barker Tool Die & Gauge Co., Detroit; gages	1,985
John Bath & Co., Inc., Worcester; gages	5,065
Bendix Aviation Corp., Eclipse Machine Division, Elmira, N. Y.; ammunition	312,000
shells	164,882
Bendix Aviation Corp., Scintilla Magneto Division, Sidney, N. Y.; parts for tanks	4,973
Bonney Forge & Tool Works, Allentown, Pa.; tools	2,890
wrenches	4,719
Boston & Lockport Block Co., E. Boston; tackle blocks	1,342
Boston Woven Hose & Rubber Co., Cambridge, Mass.; fuze bodies	49,200
Bowman, Durham, Robbins, Inc., Brooklyn; gun accessories	2,244
Brown & Sharpe Mfg. Co., Providence; fixtures	1,610
lathes	80,518
Brown, Wilson Co., New York; lathes	12,400

GOVERNMENT AWARDS

Bruner - Ritter, Inc., Bridgeport, Conn.; boosters 96,406
E. G. Budd Mfg. Co., Philadelphia; ammunition 326,646
Builders Structural Steel Co., Cleveland; steel 1,670
Carboloy Co., Inc., Detroit; cutters & tools 1,283
Carnegie-Illinois Steel Corp., S. Chicago; steel bars 39,868
Carpenter Steel Co., Philadelphia; tool steel 1,382
Centennial Cotton Gin Co., Columbus, Ga.; practice bombs 161,015
Central Iron & Steel Co., Harrisburg, Pa.; steel 1,346
Central Steel Construction Co., Buffalo; steel 1,936
Chain Belt Co., Baldwin-Duckworth Division, Springfield, Mass.; chains 1,301
Chase Brass & Copper Co., Inc., Waterbury; brass rods, bronze bars & seamless brass tubing .. 6,670
brass strips 28,017
Cincinnati Milling Machine Co., Cincinnati; clutch gears, etc. .. 1,186
E. D. Clapp Mfg. Co., Auburn, N. Y.; forgings 1,054
Cleveland Cutter & Reamer Co., Cleveland; forming blades 2,100
tools 3,400
Colt's Patent Fire Arms Mfg. Co., Hartford; pistols & magazines .. 108,763
gun components 1,842
small arms 7,491
Columbus Forge & Iron Co., Columbus, Ohio; forgings 15,710
Continental Motors Corp., Muskegon, Mich.; gears, gear pins, rod assemblies 5,355
parts for tanks 37,278
tools 6,877
Copperweld Steel Co., Warren, Ohio; steel 2,434
Corbitt Co., Henderson, N. C.; parts, misc. 1,827
Cortland Grinding Wheels Corp., Chester, Mass.; grinding wheels. 1,122
Crucible Steel Co. of America, Philadelphia; steel 8,393
Dana Tool-D. Nast Machinery Co., Philadelphia; reamers 2,415
tool bits 2,113
Davis Tool & Equipment Co., Inc., Chicago; taps 3,825
Doehler Die Casting Co., Pottstown, Pa.; closing plugs 2,271
boosters 93,000
Draper Corp., Hopedale, Mass.; ammunition 131,000
Easy Washing Machine Corp., Syracuse, N. Y.; machine gun mounts 4,322,120
Edmos Products Corp., Brooklyn; cleaning rods 2,564
Ex-Cell-O Corp., Continental Tool Works Division, Detroit; broach section details 1,063
hollow mills 1,550
Factory Service Co., Milwaukee; boxes & jimmys 13,113
L. F. Fales Machine Co., Walpole, Mass.; adapters & castings 1,375
castings 1,378
A. Finkl & Sons Co., Chicago; die blocks 1,647
Ford Motor Co., Dearborn, Mich.; installation of tank engines 76,000
M. K. Frank, New York; steel railroad rails 2,127
Gairing Tool Co., Detroit; cutters 3,192
Garman Tool & Die Co., Detroit; gages 2,238
General Fireproofing Co., Youngstown, Ohio; steel cabinets 2,125
General Floorcraft, Inc., New York; gages 2,625
General Motors Corp., AC Spark Plug Division, Flint, Mich.; oil filters 1,972
General Motors Corp., Chevrolet Motor Division, Detroit; pilot caissons 10,975
General Motors Corp., Delco Products Division, Dayton, Ohio; shells 191,250
General Motors Corp., Detroit Diesel Engine Division, Detroit; installation of tank engines 75,000
General Motors Corp., Hyatt Bearings Division, Chicago; bearings. 7,108
General Motors Corp., Olds Motor Works Division, Lansing, Mich.; guns 2,350,000
General Power, Inc., Quapaw, Okla.; ammunition 19,445
Gibson Electric Refrigerator Co., Greeneville, Mich.; ammunition chests 604,782
Gleason Works, Rochester, N. Y.; tools 1,275
Globe Forge & Foundries, Inc., Syracuse, N. Y.; forgings 1,653
Graybar Electric Co., Inc., Boston; wire & cable 4,487
Great Lakes Steel Corp., Ecorse, Detroit; rails 9,685
Greenfield Tap & Die Corp., Greenfield, Mass.; gages 11,811
Gries Reproducer Corp., New York; gages 10,447
Guiberson Diesel Engine Co., Chicago; engines 2,455,301
Haines Gauge Co., Inc., Philadelphia; gages 1,245
Hanson-Whitney Machine Co., Hartford, Conn.; gages 1,700
Louis Hanssen's Sons, Davenport, Iowa; screw drivers & twist drills 1,387
snap bolts & gimp tacks 4,747
hinges 1,033
Hesse Machine & Mfg. Co., Boston; gages 3,625
Hollup Corp., Chicago; welding .. 2,389
Independent Pneumatic Tool Co., Chicago; hose couplings 1,300
International Harvester Co., Chicago; tractors 1,270,116
International Nickel Co., Inc., Huntington, W. Va.; cylinders.. 319,485
JCH Automatic Machine Works, Philadelphia; inserts for machines 1,567
Richard V. Jobst, Chicago; axes.. 7,662
Jones & Lamson Machinery Co., Springfield, Vt.; lathes 5,762
Jones & Laughlin Steel Corp., Pittsburgh; steel pipe 1,338
Joslyn Mfg. & Supply Co., Chicago; ammunition 13,974
Ken-Wel Sporting Goods Co., Inc., Utica, N. Y.; ammunition bags. 16,300
Keolyn Plastics Co., Chicago; windows 1,720
Wm. F. Klemp Co., Inc., Chicago; armor, and anchors, for paving. 1,975
Kloster Steel Corp., Chicago; steel 4,989
H. R. Krueger & Co., Detroit; chambering machines 42,800
Leitelt Brothers, Chicago; bronze castings 1,040
Liberty Tool & Gage Works, Inc., Providence; gages 44,481
Lincoln Park Tool & Gage Co., Lincoln Park, Mich.; gages 1,130
Lindberg Engineering Co., Chicago; furnaces & equipment ... 4,678
Link-Belt Co., Indianapolis; castings 1,000
Liquid Carbonic Corp., Chicago; ammunition 83,389

GOVERNMENT AWARDS

Lovell Mfg. Co., Erie, Pa.; tripod mounts 409,630
Lyman Gun Sight Corp., Middlefield, Conn.; sight parts 24,190
Lyon Metal Products, Inc., Davenport, Iowa; parts for shelving equipment 2,263
McCord Radiator & Mfg. Co., Detroit; helmets 2,307,368
McGill Mfg. Co., Valparaiso, Ind.; ball bearings 17,394
Mack Mfg. Corp., New York; prime movers 67,960
gages 1,118
Master Machine & Tool Co., Chicago; gages 1,257
Mattison Machine Works, Rockford, Ill.; sanders 2,397
saws 2,468
Merco Co., Los Angeles; gages .. 10,016
Merz Engineering Co., Indianapolis; gages 3,857
Midvale Co., New York; suspension rods 6,518
Midwestern Tool Co., Chicago; gages 10,449
Minneapolis Moline Power Implement Co., Minneapolis; shells.. 805,200
Moore Special Tool Co., Inc., Bridgeport, Conn.; punches & dies 7,890
National Acme Co., Cleveland; circular chasers 1,104
machine parts 1,117
National Cash Register Co., Dayton, Ohio; shell housings 147,490
National Lock Co., Rockford, Ill.; hinges, hasps & swivel assemblies 26,385
screws and bolts 2,596
New Jersey Machine Corp., Hoboken, N. J.; labeling machines 23,940
Niles-Bement-Pond Co., Pratt & Whitney Division, W. Hartford; tables, tilting rotary 2,480
cutting tools 1,386
tools 1,480
Nineteen Hundred Corp., St. Joseph, Mich.; machine gun mounts 4,322,120
Nunn Mfg. Co., Evanston, Ill.; shells 66,285
Ohio Seamless Tube Co., Shelby, Ohio; seamless steel tubes 1,314
Oilwell Supply Co., Oil City, Pa.; shells 125,955
Oliver Farm Equipment Co., Chicago; shells 154,837
Otis Elevator Co., Buffalo; castings 6,876
Parent Metal Products, Inc., Philadelphia; work benches 1,965
Parker-Kalon Corp., New York; screws, socket head & sets, safety 1,011
Peoria Tractor & Equipment Co., Rep. of Caterpillar Tractor Co., Peoria, Ill.; parts for tractors.. 1,070
Perfect Surface Plate Co., Van Dyke, Mich.; surface plates ... 1,423
Pipe Machinery Co., Cleveland; gages, thread rings & check plugs 8,246
Plume & Atwood Mfg. Co., Thomaston, Conn.; brass strips 41,035
Poor & Co., Canton Forge & Axle Works, Canton, Ohio; drop forgings & grimming dies 10,125
Precise Tool & Mfg. Co., Farmington, Mich.; gages 4,987
Precision Castings Co., Cleveland; boosters 93,990
Precision Mfg. Co., Dover, N. J.; gages 28,426
Henry Prentiss & Co., New York; drilling & boring machines 23,120
tools 6,000
Putnam Tool Co., Detroit; cutting tools 8,590
W. B. Rapp Machinery Co., Philadelphia; lathes 1,942
Read Machinery Co., Inc., York, Pa.; gun parts 5,571
Reasoner Tool & Supply Co., Detroit; hacksaw blades 5,540
Remington Arms Co., Inc., Bridgeport, Conn.; cartridges 6,358
Remington Rand, Inc., Washington; filing cabinets 2,211
Republic Electric Co., Davenport, Iowa; cable 5,008
Revere Copper & Brass, Inc., Chicago; brass 3,412
Reynolds Metals Co., Louisville, Ky.; aluminum strip 2,028
Robertshaw Thermostat Co., Youngwood, Pa.; shells 130,618
Rockwood Sprinkler Co., Boston; fire prevention equipment 2,812
Rotary Electric Steel Co., Ferndale Station, Detroit; steel 2,972
St. Pierre Chain Corp., Worcester; forgings 2,628
Scaife Co., Oakmont, Pa.; air tanks 1,972
Schlosser Mfg. Co., Inc., Philadelphia; gages 1,225
Schwitzer-Cummins Co., Indianapolis; cartridge cases 253,597
Seymour Mfg. Co., Seymour, Conn.; bronze bars 2,260
Sharples Corp., Philadelphia; centrifuges & clarifier bowls 2,685
W. E. Shipley Machinery Co., Philadelphia; grinders 6,849
Smalley General Co., Bay City, Mich.; thread milling machines. 17,704
Thomas Smith Co., Worcester; disks 3,864
Specialty Engineering Co., Philadelphia; motor starter equipment 6,351
conveyors & boosters 5,439
Standard Gage Co., Inc., Poughkeepsie, N. Y.; gages 4,345
Standard Forgings Corp., Indiana Harbor, Ind.; shells 390,720
Standard Machinery Co., Providence; roller bearings 1,564
Standard Steel Spring Co., Blood Brothers Machine Co. Division, Allegan, Mich.; steel joints 2,548
propeller shafts 1,378
B. F. Sturtevant Co., Springfield, Mass.; exhaust fans 1,384
Suburban Essex Machinists, Inc., Orange, N. J.; gages 8,650
Superior Steel Corp., Pittsburgh; cups, for guns 4,750
Swartzbaugh Mfg. Co., Toledo, Ohio; packing cans 5,096
Swind Machinery Co., Philadelphia; milling machines 4,829
Taft-Peirce Mfg. Co., Woonsocket, R. I.; gages 1,300
Timken Detroit Axle Co., Detroit; gear boxes 82,976
Timken Roller Bearing Co., Canton, Ohio; journal boxes 56,376
ammunition 125,000
bearings 3,528
steel 1,741
Triad Tool & Die Co., Newark; staking pins 5,600
Triumph Explosives, Inc., Elkton, Md.; percussion element assemblies 194,625
Troy Foundry Co., Inc., Troy, N. Y.; castings 1,078
Union Spring & Mfg. Co., New Kensington, Pa.; springs 2,736
Unit Drop Forge Division of Fuller Mfg. Co., West Allis, Wis.; forgings 31,134
U. S. Hoffman Machine Corp., New York; conveying equipment, etc. 9,466
Universal-Cyclops Steel Corp., Titusville, Pa.; steel 3,133
Universal Metal Products Co., Inc., New York; extractor spindles .. 2,511
Van Dyck Churchill Co., New York; chucks 1,575
tools 24,028
Veit & Young, Philadelphia; canneluring attachments 1,360
Vinco Corp., Detroit; gages 7,191
Vulcan Mold & Iron Co., Latrobe, Pa.; molds 3,426
Wagner Electric Corp., St. Louis; ammunition 25,200
Waltham Gage Co., Detroit; shells 3,600
Warner Electric Brake Mfg. Co., Beloit, Wis.; jumper cables, safety chain assemblies & cable clamps 6,945

GOVERNMENT AWARDS

Watson-Stillman Co., Roselle, N. J.; intensifiers, pumps & motors 3,806
Frank M. Weaver & Co., Inc., Lansdale, Pa.; structural steel building 44,775
steel 8,882
Weaver Mfg. Co., Springfield, Ill.; trucks 17,953
Weinstein Supply Co., New York; padlocks & pin punches 1,755
mattocks 1,945
West Tire Setter Co., Rochester, N. Y.; presses 367,850
Western Cartridge Co., Winchester Repeating Arms Co. Division, New Haven, Conn.; rifles 5,807,742
Western Corp., Chicago; roller bearings 12,675
White Motor Co., Cleveland; parts for scout cars 1,674
Whitman & Barnes, c/o General Tool Sales Co., Philadelphia; drills 4,110
Winter Weiss Co., Denver; trailers 27,790
John Wood Mfg. Co., Inc., Muskegon, Mich.; parts for recoil mechanisms 74,452
Wright Aeronautical Corp., Paterson, N. J.; tools 109,468
Zimmerman Steel Co., Bettendorf, Iowa; castings 3,763

War Dept., Air Corps:

American Chain & Cable Co., Inc., American Cable Division, Wilkes-Barre, Pa.; cable $51,051
American Steel & Wire Co. of N. J., Columbus, Ohio; cable 51,051
Artos Engineering Co., Milwaukee; stand assemblies & tachometers. 42,250
Boeing Aircraft Co., Seattle, Wash.; parts for airplanes 213,163
engine cowl rings 98,142
Butler Mfg. Co., Kansas City, Mo.; portable warehouses 1,649,476
Curtiss-Wright Corp., Curtiss Propeller Division, Caldwell, N. J.; power unit assemblies 190,832
spare parts 119,186
Garland Mfg. Co., Saco, Maine; hammers & malletts 53,589
Jacobs Aircraft Engine Co., Pottstown, Pa.; parts for airplane engines 92,730
General Motors Corp., Delco Products Division, Dayton, Ohio; motor assemblies 43,821
Lockheed Aircraft Corp., Burbank, Cal.; airplane parts 10,966,152
Snap-On Tools Corporation, Kenosha, Wis.; tools 342,660
Trailer Co. of America, Cincinnati; semi-trailers 1,759,065
Vlchek Tool Co., Cleveland; tools. 257,290
J. H. Williams & Co., Buffalo; tools 232,400
Wire Rope Corp. of America, Inc., New Haven, Conn.; cable 51,051
Wright Tool & Forge Co., Barberton, Ohio; tools 205,953

War Dept., Chemical Warfare Service:

Cleveland Twist Drill Co., Cleveland; drills $824
Continental Can Co., New York; equipment for gas masks 1,150
Crucible Steel Co. of America, New York; tool steel 1,556
Duquesne Smelting Corp., Pittsburgh; zinc dust & drums 3,960
L. F. Grammes & Sons, Inc., Allentown, Pa.; grammets & washers 7,322
Leeds & Northrup Co., Philadelphia; vapo-carb furnaces 2,727
Miller Co., Meridian, Conn.; brass 15,747
Morgan Machine Co., Inc., Rochester, N. Y.; box nailing machines 1,931
Pennsylvania Pump & Compressor Co., Easton, Pa.; air compressors 14,918
Singer Sewing Machine Co., Baltimore; sewing machine parts 1,513
Stevens Metal Products Co., Niles, Ohio; drums 10,800

XMAS GREETINGS: An "All-out" wish for Christmas is being sent out by American Rolling Mill Co., with every shipment of iron, steel, and stainless steel sheets.

Stewart-Warner Corp., Chicago; elbow nozzles 9,795
Torrington Co., Philadelphia; needles 1,533
United-Carr Fastener Corp., Cambridge, Mass.; clinch plates, sockets, studs, washers, etc. 16,360
dies & machine parts 833
U. S. Pipe & Foundry Co., Philadelphia; tees, sleeves, bends & pipes 823
Wackman Welded Ware Co., Chester, Pa.; drums 65,520
Wolverine Tube Co., Detroit; seamless brass tubing 23,328

War Dept., Signal Corps:

American Automatic Electric Sales Co., Chicago; tool equipment $1,025
Chicago Tool & Kit Mfg. Co., Chicago; tool sets 67,481
Crosbie Co., Washington; grinder benches 1,624
Eastern Tool & Mfg. Co., Bloomfield, N. J.; reels 1,224
Graybar Electric Co., New York; cables & reels 5,927
wire 34,400
Gussack Machined Products Co., Long Island City; stakes 681
Horton Mfg. Co., Bristol, Conn.; mast bases & sections 3,418
Karp Metal Products Co., Brooklyn; metal cabinets 1,759
Linde Air Products Co., New York; tanks 682

GOVERNMENT AWARDS

Parish Pressed Steel Co., Reading, Pa.; reels 537
Peter A. Petroff, New York; stakes 1,479
Utilities Service Co., Allentown, Pa.; stakes 1,900
Victor Tool Co., Reading, Pa.; knives & honing stones 8,325
Widin Metal Goods, Garwood, N. J.; mast bases & sections 3,653
Widin Metal Goods Co., Garwood, N. J.; hooks 1,304

War Dept., Corps of Engineers:

American Monorail Co., Cleveland; cranes & craneways, Aircraft Assembly Plant, Kansas City, Kan. $95,922
Burge Fence & Iron Works, Kansas City; chain link fence, Marshall Field, Ft. Riley, Kan. ... 7,906
M. R. Carpenter, Sacramento, Cal.; automatic sprinkler system, Mather Field, Cal. 5,576
Fiat Metal Mfg. Co., Inc., Long Island City, N. Y.; metal doors & partitions, Bolling Field, D. C. 671
Freyn Bros., Inc., Indianapolis; special type steel racks & steel frame tables 31,713
Grinnel Co. of the Pacific, San Francisco; automatic sprinkler system, Stockton, Cal., Airfield. 5,510
Regina Heller, Los Angeles; guard rail posts, mounting bolts, nuts, bevel washers & braces 10,539
L. R. Kohl, Springfield, Ohio; bucket backhoe 2,600
Price Brothers Co., Dayton, Ohio; scraper with tractor 3,680

WELDING ON POSTAGE: In recognition of the tremendous part arc welding plays in the war effort, the Union of South Africa, issued a special welding postage stamp.

Titusville Iron Works Co., Titusville, Pa.; water tubes, low head, oil-fired boilers with fitters, soot blowers, tube cleaner & tools ... 14,849
Trewhitt-Shields & Fisher, Fresno, Cal.; incinerator, Fresno, Cal., Airfield 3,657

War Dept., Quartermaster Corps:

G. F. Kremkau & Son, Pittsburg, Cal.; motor launches 22,000
Lincoln Engraving Co., Baltimore; guns, lubricating 3,062

Mack Mfg. Corp., Plainfield, N. J.; parts for trucks 20,876
Pearson Construction Co., Inc., Benton Harbor, Mich.; 5-ton incinerator, Jeffersonville QM Depot, Ind. 20,800
American Chain Link Machine Co., Los Angeles; fencing and gates, Sherwood Field, Paso Robles, Cal. $6,320
Darby Products of Steel Plate, Kansas City, Kan.; water tank, Ft. Moultrie, S. C. 25,984
Delta Electric Co., Marion, Ind.; lanterns, electric 22,800
Doehler Metal Furniture Co., Inc., New York; litters 7,067
Economy Electric Lantern Co., Milwaukee; lanterns, electric .. 15,200
Ford Motor Co., Dearborn, Mich.; five-passenger cars $113,460
General Motors Corp., Chevrolet Division, Norwood, Ohio; trucks 646
Gray Marine Motor Co., Detroit; diesel engines 15,368
Hall Scott Motor Car Co., New York; engines 90,250
Tempte Brothers, Denver; semi-trailers, 2-wheel 103,019

Defense Plant Building:

Gus Reimke Machinery & Tool Co., Newark; construction and equipping of plant for manufacture of machine tools $120,620
Vickers, Inc., Detroit; additional plant facilities and equipment for production of hydraulic controls and aircraft devices 8,590,957

PERSONALS . . .

• **John H. Ashbaugh** has been appointed manager of manufacturing and engineering of the merchandising division of the Westinghouse Electric & Mfg. Co., East Pittsburgh. Mr. Ashbaugh has been acting manager of the two departments since January, 1941. He directs the manufacturing and engineering activities of the two merchandising division plants in Mansfield, Ohio, and Springfield, Mass. Starting with the company in 1918 as a student engineer in the East Pittsburgh works, he went to the Westinghouse merchandising division as assistant manager of engineering of the Springfield works in 1931. In less than a year, he was named manager of engineering.

• **J. W. McNairy,** who has been associated in various engineering and manufacturing capacities with the General Electric Co. for 24 years, has been appointed assistant manager of the Bridgeport works of the General Electric Co. Mr. McNairy was graduated from the North Carolina State College in 1917 with a degree of B.S. in electrical engineering and immediately afterward entered the G-E student engineering course at Schenectady. Holder of 39 patents, and twice recipient of G-E's Charles A. Coffin award, much of Mr. McNairy's service with the company has been in connection with its transportation activities. He first became associated with the company's railway department in 1920 and in 1928 was made assistant design-engineer for the control division of the transportation department. He held this position until he was transferred to Bridgeport in 1940 to become assistant to the manager in charge of engineering.

• **Russell J. Greenly,** chief of training and education of the Carnegie-Illinois Steel Corp., Pittsburgh, has assumed additional duties as acting chief of the personnel division, replacing **J. Edward Johnson,** who was recently made superintendent of industrial relations at Clairton works. Mr. Greenly began his industrial career with E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., in 1914 and in 1921 became associated with the Sun Shipbuilding Co. at Gloucester, N. J. Entering the field of education in 1922, he was director of voice education at Abington High School, Montgomery County, Pa., and in 1927 became a professor at Akron University. From 1936 to April of this year, Mr. Greenly was a professor at Purdue University.

Charles D. Feight, formerly superintendent of industrial relations at Clairton, has been transferred to the staff of the vice-president in charge of industrial relations at Pittsburgh. **Edward P. Woodward,** who has been personnel assistant at Pittsburgh, has been added to the industrial relations staff of the Youngstown District Works.

• **Paul W. Rhame,** works manager, and **Charles W. Crick,** assistant to the general manager of AC Spark Plug division of General Motors Corp., Detroit, have been named executive assistants to **George Mann, Jr.,** general manager. Mr. Rhame will head the machine gun production activity and production of other defense items. Mr. Crick will be executive assistant on automotive and regular products. **Joseph Anderson,** assistant works manager, has been appointed works manager in charge of both defense and automotive products. **Miles Hanson,** superintendent, has been made assistant works manager of the machine gun department and **Lee Sherrod,** superintendent, will be assistant works manager on automotive and regular products. **Morris Allen** has been named to assist Mr. Rhame on machine guns and **Meredith Spear** will assist on new defense products activity.

JOHN H. ASHBAUGH, manager of manufacturing and engineering of the merchandising division, Westinghouse Electric & Mfg. Co., East Pittsburgh.

• **L. C. McAnly** has been named works manager of Fruehauf Trailer Co., Detroit. Mr. McAnly joined Rockwood Mfg. Co. upon graduation from Purdue University in 1917, served as factory superintendent of the company between 1920 and 1934 and then went to Maytag Co., Newton, Iowa, as assistant factory manager. In 1936 he returned to Rockwood as factory manager and continued there until joining Fruehauf.

• **Allan Cunningham** has joined the National Smelting Co., Cleveland, to handle priority matters, among other things for the company. For the past four years, Mr. Cunningham had been with the United States Government in Washington. He had been connected with the Bureau of Labor Statistics of the Department of Labor as industrial economist since the summer of 1940 and will continue as industrial consultant to the bureau.

• **Eugene King,** former assistant manager, has been named manager of the Cleveland branch of John A. Roebling's Sons Co., Trenton, N. J., replacing **Raymond R. Newell** who has retired after having been in charge of the Cleveland organization since 1911. Mr. King was first employed by the Roebling company in 1917 and in 1926 became salesman in charge of the Detroit area. He was appointed assistant manager of the Cleveland branch in 1941.

• **Joseph A. Sullivan,** assistant publicity manager of the Chicago Pneumatic Tool Co., New York, has been promoted to advertising manager. Joining the Chicago Pneumatic organization in 1928, Mr. Sullivan served until 1932 as head of the direct mail division of the company's publicity department. From 1932 until 1935, he was with Sweet's Catalog Service division of the F. W. Dodge Corp.

but rejoined Chicago Pneumatic in 1935 as assistant publicity manager.

• **Dr. Charles E. Lucke** has been appointed consultant to the Chemical Construction Corp., New York, in the selection and installation of power generating and mechanical equipment. Dr. Lucke retired this year from his long-held post as head of the department of mechanical engineering and had held advisory positions with the Worthington Pump & Machinery Corp. and the Babcock & Wilcox Co.

• **F. Royal Gammon** has been appointed as manager of sales of the New York district sales office, Carnegie-Illinois Steel Corp. Mr. Gammon will succeed **James R. Mills,** who will retire after many years of service. Mr. Gammon has been in the steel business for many years, having at one time served with the Bethlehem Steel Co., with the Chicago Belting Co. and as vice-president of the Neptune Meter Co., New York. Mr. Gammon joined the selling force of the Carnegie-Illinois Steel Corp. as special representative in 1936 and on Jan. 1, 1938, was made manager of sales in Cleveland, which position he now relinquishes to become manager of sales in New York.

• **Harry D. Bubb,** has been promoted to director of engineering for Cleveland plant of Thompson Products, Inc., and the new $13,000,000 Euclid factory of the company's subsidiary, Thompson Aircraft Products Co. Mr. Bubb was formerly chief engineer of the Cleveland plant of Thompson, and will be in direct charge of the Thompson metallurgical and chemical laboratories and the coordinating of all engineering activities. He joined Thompson Products after being graduated from Case School of Applied Science in 1925.

• **Walter S. Tower,** president of American Iron and Steel Institute, has been notified of his election as an honorary member of the Iron and Steel Institute of Great Britain. Mr. Tower is the only living American to be so honored.

• **Dr. Raymond G. Spencer,** has been appointed chairman of metallurgical research of the Armour Research Foundation, Chicago. Dr. Spencer joined the staff of the Armour Research Foundation as research physicist in June, 1941, while on leave of absence from Albion College, Albion, Mich.

Dr. William H. Earhart has joined the Armour staff as ceramist in the metallurgy section. Others who have joined the Armour Research Foundation include: **Clark E. Thorp,** chemical engineer; **Dr. Clyde W. Leaf,** organic chemist; **George Stern,** metallographer, and **Robert C. Bour,** chemical engineer.

• **Ray Chamberlain** has resigned from the Packard Motor Car Co., Detroit, to take over his new post as executive vice-president of the National Automotive Dealers Association. Mr. Chamberlain entered the motor industry in 1906 as an apprentice machinist for the H. E. Wilcox Motor Car Co. of Minneapolis. He left the Wilcox company in 1915 to become manager of the Garford Motor Truck Co. at its Philadelphia branch and in 1916 joined the Packard Motor Car Co. as director of sales for trucks in the New York area. In 1917, he was transferred to Detroit to become truck sales manager for the company. He was made general sales manager of the Packard Motor Car Co., in 1921 and in 1937 was appointed manager of merchandising.

• **G. M. Henderson** has been named assistant to the general purchasing agent of the American Brake Shoe & Foundry Co., New York, filling the position left vacant by the death of W. E. Sault.

• **George A. Mattison, Jr.,** president of Woodstock Slag Corp., Birmingham, has been elected president of the Birmingham, Ala., Chamber of Commerce. He will take office Jan. 1.

• **John Bridge,** vice-president and general manager of the Inter-State Motor Freight System for the past nine years, will become chairman of the board of directors under a staff reorganization. **W. F. Drohan,** former Western regional vice-president, has been named vice-president and general manager of the entire system succeeding Mr. Bridge.

OBITUARY...

• **Samuel Pennock,** superintendent of the coke works at Otis Steel Co., Cleveland, died Nov. 25, at the age of 57. He had been associated with Otis Steel for 25 years.

• **W. E. Sault,** assistant to the general purchasing agent of the American Brake Shoe & Foundry Co., died Nov. 29, following a heart attack. Mr. Sault started with the Brake Shoe company's Ramapo Ajax division in September, 1901, and was transferred to the general purchasing department of the Brake Shoe company in 1923. His specialty for years has been the purchase of scrap, pig iron, steel, coal and coke.

• **Julian Roe,** for many years Western sales manager of the Crocker-Wheeler Electric Mfg. Co., Ampere, N. J., died at his home in Chicago on Nov. 24. In 1894, one year after joining Crocker-Wheeler, Mr. Roe supervised the installation (at the Pencoyd Iron Works, later to become part of the American Bridge Co.) of the first electric control system for transfer roll tables ever to be used in a steel mill. In 1899 he was appointed Chicago district manager for Crocker-Wheeler, and in 1927 Western sales manager with offices in Chicago.

• **William J. Radcliffe,** president of the E. A. Kinsey Co., distributers of machine tools and mill supplies, died at his home in Cincinnati Dec. 1. Mr. Radcliffe started his career as an apprentice in the shop of Laidlaw-Dunn-Gordon Co., in Cincinnati, and worked his way through the shop into the sales organization. In 1896 he joined the Kinsey Co. as a mill supply salesman, later serving in the machine tool department. He became president and general manager of the company in 1910.

• **Minnie L. Arth,** aged 70 years, president and treasurer, Arth Brass & Aluminum Castings Co., Cleveland, died Nov. 29. Mrs. Arth had been head of the castings company since the death of her husband, Michael Arth, the founder, in 1920.

• **Andrew B. Graf,** design engineer of the Cincinnati Milling Machine Co., died Dec. 3, at his home in Norwood, Ohio. He was 46

years old. Mr. Graf was born in Cincinnati and was a graduate of St. Joseph College. He supplemented this training with graduate work at the University of Cincinnati.

• **George Mower** died in London at the age of 82 years. A graduate of the Massachusetts Institute of Technology, he entered business with the Sturtevant Blower Works, Boston, eventually going to London as the firm's representative. He later became a director of several British manufacturing concerns.

• **James M. Schoonmaker, Jr.,** well known engineer and industrialist, died Dec. 1 at his home in Pittsburgh. Mr. Schoonmaker was vice-president of Standard Steel Spring Co., Coraopolis, Pa., for several years and from 1930 to 1934 was president of the General Aviation Corp. of Baltimore. Since his retirement from the presidency of that company, he had continued as a director of the Standard Steel Spring Co., the Union Spring & Mfg. Co. and the Union Storage Co. He was 53 years old.

• **Orlin W. Benham,** vice-president of Nicholson Universal Steamship Lines, Detroit, was killed recently when his automobile was struck by a fast passenger train in Detroit. Mr. Benham was 59 years old and had been an executive of the Nicholson firm since 1932 when he was placed in charge of operations. In 1937 he was elevated to vice-president. Prior to 1933 he was employed by the United States Shipping Board in the East.

• **M. A. Louth,** Kokomo, Ind., industrial advertising counsel, died Dec. 1. Mr. Louth had been associated for many years with the Haynes Stellite Co. and at one time was sales manager of General Chromium Co., Detroit.

• **Lt.-Comm. D. P. Heath,** of the United States Naval Aircraft Factory in Philadelphia, died Nov. 30 of injuries received when he was struck by an automobile. After retiring from the Navy in 1920, he served as refrigeration engineer of the Kelvinator and Servel Corp., construction engineer for the Westinghouse Electric & Mfg. Co., chief refrigeration engineer of the Crosley Radio Corp. and of the air-conditioning division of the McCord Radiator & Mfg. Co. At the time he was recalled to active duty, he was president of the Frigid Vending Co., Detroit.

• **Albert Pack,** chairman of the board, Continental Roll & Steel Foundry Co., died in Chicago recently. Mr. Pack went to Chicago from Pittsburgh in 1910 to found the Hubbard Steel Foundry Co. jointly with J. W. Hubbard, in East Chicago. In 1930, Hubbard was merged with Continental, and Pack was named chairman. He held a similar post with Detroit Seamless Steel Tube Co.

The late AUGUST P. MUNNING, chairman of the board of the Hanson-Van Winkle-Munning Co. until 1935 and a member of the company's executive committee until 1940, whose death was announced in these columns Nov. 20.

• **Harry C. Gowran,** president of the Hamilton Mfg. Co., Two Rivers, Wis., died at his home in Two Rivers Nov. 21 after a heart failure attack at the age of 70 years. He became associated with the Hamilton company as a bookkeeper and rapidly rose to office manager in 1898. As a sideline he organized the American Cabinet Co. for the dental field, which grew so rapidly it was merged with the Hamilton firm in an exchange of stock and Mr. Gowran was made treasurer. In 1915 he was made vice-president and in 1933 became president to succeed George Hamilton.

• **J. Walter Drake,** Assistant Secretary of Commerce from 1923 to 1927, and former president of Hupp Motor Car Co., Detroit, died Nov. 27 at his home at Lake Angelus, a few miles from Detroit. He was 66 years old. Mr. Drake was one of the founders of Hupp in 1908 and was engaged recently in attempts to reorganize the concern. His appointment to the Commerce Department came from President Harding, when Herbert Hoover was secretary. Besides having been head of Hupp, he was a director of the Norge Corp., the Detroit Gear & Machine Co., the Detroit Pressed Steel Co., the Charcoal Iron Co. of America, and was president of the Central Drug Co.

• **John Jay Coapman,** pioneer in the automobile industry, died Nov. 23 in Detroit. Born in Rochester, N. Y., in 1888, Mr. Coapman went to Detroit in 1909 and was chief engineer for the Denby Motor Truck Corp. and the Russell Motor Axle Co. He later was connected with Flint Motor Axle Co., Flint, Mich.; Spicer Mfg. Corp., Toledo; Motor Wheel Corp., Lansing, and Vacuum Shift division of Evans Products Corp., Detroit.

Stove Output Will Be Limited, Delegates Told

Cincinnati

• • • **An order** restricting production of stoves will be announced in a few days, Henry A. Dinegar, chief of the stove, refrigeration and air conditioning unit of OPM told delegates to the convention of the Institute of Cooking and Heating Appliance Manufacturers, here last Thursday. He assured delegates the order would not bring stove output below the 1935-39 level of production.

Polishing Being Restricted On Small Arms

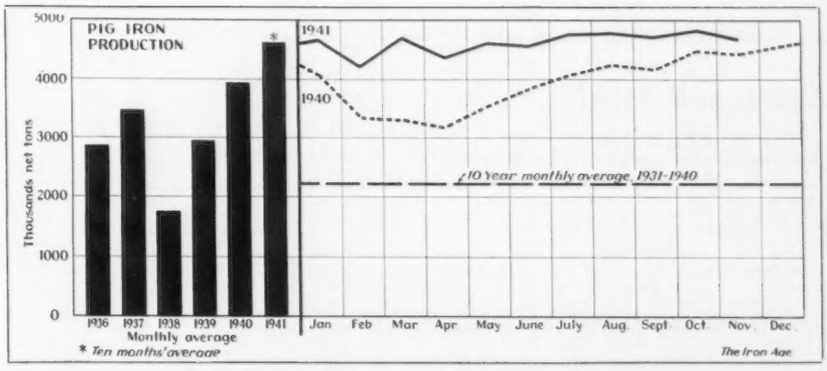
Boston

• • • **Although represented** by only a relatively small industry, metal polishing is slated for a drastic curtailment all because the government doesn't want a glint to appear on any of its pistols, machine guns and munitions generally. Already hundreds of polishers, platers and buffers have been laid off because of government restrictions and others will be forced out of work, it is reported here.

Iron Output Up On Daily Basis in November

• • • **Coke pig iron** production in November dropped to 4,702,927 net tons compared with 4,856,306 tons in October and 4,716,901 tons in September, the previous 30-day month. Output on a daily basis last month increased slightly to 156,764 tons from 156,655 tons a day in October. The operating rate for the industry in November was 97.7 per cent of the new increased capacity of 160,408 net tons a day compared with 98.2 per cent in October.

Two hundred fifteen furnaces were in blast Dec. 1, producing at the rate of 156,855 tons a day, compared with 214 in blast on Nov. 1 with a production rate of 156,265 tons. The United States Steel Corp. took one furnace off blast. Independent producers put three in and took off two and merchant producers blew in two furnaces and took off two.



Furnaces blown included: One Lackawanna, Bethlehem Steel Co.; one Brier Hill, Youngstown Sheet & Tube Co.; one Toledo, Pickands, Mather & Co., and one Palmerton, New Jersey Zinc Co.

Among the furnaces blown out or banked were: One Central American Steel & Wire Co.; one National, National Steel Co., and two Woodward, Woodward Iron Co.

Production by Districts and Coke Furnaces in Blast (In Net Tons)

	November, 1941		October, 1941			Dec. 1, 1941		Nov. 1, 1941	
		Daily % of Capacity		Daily % of Capacity	November, 1940	No. in Blast	Operating Rate	No. in Blast	Operating Rate
Eastern	37,912	112.2	39,987	114.5	38,614	2	1,265	2	1,290
Buffalo	293,992	89.5	306,992	98.8	270,280	15	10,475	14	9,905
Philadelphia	456,697	100.4	447,884	95.3	389,795	19	15,225	19	14,820
Ferro. and Spiegel	14,541	85.5	16,966	96.5	9,552	4	540	3	390
Pittsburgh	1,093,086	94.5	1,148,544	96.1	1,052,981	47	36,060	48	37,050
Ferro. and Spiegel	40,021	95.4	46,631	107.6	27,067	4	1,335	4	1,310
South Ohio River	99,370	94.4	103,788	95.4	84,702	7	3,310	7	3,350
Valleys	572,511	101.1	578,274	98.8	531,922	25	19,665	24	18,655
Wheeling	198,407	99.9	210,303	102.3	191,129	9	6,615	9	6,785
Cleveland	388,560	98.5	405,863	99.5	367,285	16	12,830	16	13,090
Spiegeleisen	.....	...	.....	...	4,758	0	.....	0	.....
Chicago	1,005,827	97.9	1,033,759	97.4	945,077	40	33,530	40	33,380
St. Louis	23,278	110.7	22,817	105.0	.....	1	775	1	735
Detroit	101,877	90.7	89,582	77.2	114,783	4	3,395	4	2,890
Western	65,398	107.5	67,688	107.7	66,443	4	2,180	4	2,185
Southern	310,139	102.3	334,690	106.8	306,500	17	9,610	18	10,350
Ferromanganese	1,311	15.1	2,538	27.5	2,342	1	45	1	80
Total	4,702,927	97.7	4,856,306	98.2	4,403,230	215	156,855	214	156,265

Production of Coke Pig Iron and Ferromanganese

	Pig Iron*		Ferro-Mn†	
	1941	1940	1941	1940
January	4,663,695	4,032,022	35,337	43,240
February	4,197,872	3,311,480	33,627	38,720
March	4,704,135	3,270,499	37,808‡	46,260
April	4,334,267	3,137,019	44,341	43,384
May	4,599,966	3,513,683	47,256	44,973
June	4,553,165	3,818,897	42,582	44,631
½ year	27,053,100	21,083,600	240,951	261,208
July	4,770,778	4,053,945	47,193	43,341
August	4,791,432	4,238,041	52,735	37,003
September	4,716,901	4,176,527	46,932	33,024
October	4,856,306	4,445,961	55,495	32,270
November	4,702,927	4,403,230	47,669	31,155
December	.....	4,547,602	.....	35,666
Year	.....	46,948,906	.....	473,667

*These totals do not include charcoal pig iron. †Included in pig iron figures. ‡Revised from March to July to omit spiegeleisen production.

Daily Average Production of Coke Pig Iron

	1941	Per Cent Capacity	1940	Per Cent Capacity
January	150,441	95.5	130,061	85.8
February	149,924	95.2	114,189	75.1
March	151,745	96.9	105,500	68.9
April	144,475	91.8	104,567	68.6
May	148,386	93.8	113,345	74.8
June	151,772	95.9	127,297	83.9
½ year	149,465	94.5	115,844	76.1
July	153,896	97.1*	130,772	86.3
August	154,562	97.5	136,711	90.4
September	157,230	98.8	139,218	92.2
October	156,655	98.2	143,418	94.8
November	156,764	97.7	146,774	97.1
December	.....	...	146,697	97.2
Year	.....	...	128,276	84.6

*Revised for capacity as of June 30, 1941.

Merchant Iron Made, Daily Rate

	1941	1940	1939
January	20,812	16,475	11,875
February	21,254	14,773	10,793
March	23,069	11,760	10,025
April	20,434	13,656	9,529
May	21,235	16,521	7,883
June	21,933	13,662	8,527
July	21,957	16,619	9,404
August	22,578	17,395	11,225
September	21,803	17,571	12,648
October	23,243	18,694	16,409
November	22,690	22,792	16,642
December	.....	19,779	16,912

CONSTRUCTION STEEL

. . . STRUCTURAL STEEL, REINFORCING BARS, PLATES, PILING, ETC.

Fabricated Steel

Lettings of 16,400 tons compare with 14,450 tons last week; new projects decline to 9950 tons from 14,650 tons; plate awards call for 2355 tons.

NORTH ATLANTIC STATES
AWARDS

3000 Tons, Boston Navy Yard, nine-story building, to American Bridge Co., Pittsburgh, through Thomas O'Conner Co., Boston, contractor.

1970 Tons, Watervliet, N. Y., three arsenal buildings, to Bethlehem Steel Co., Bethlehem, Pa.

175 Tons, Philadelphia, Bala Theater building, to Bethlehem Steel Co., Bethlehem, Pa.

860 Tons, Williamsport, Pa., Lycoming Division of Aviation Corp., to Anthracite Bridge Co., Scranton, Pa.

THE SOUTH

730 Tons, Watson, Ark., bridge No. 87 for Missouri Pacific Railroad Co., to American Bridge Co., Pittsburgh.

CENTRAL STATES

3360 Tons, Grand Blanc, Mich., manufacturing and office building for Fisher Body Division, General Motors Corp., to R. C. Mahon Co., Detroit.

987 Tons, Louisiana, Mo., power house for ordnance plant, to Ingalls Iron Works Co., Pittsburgh plant.

717 Tons, Lima, Ohio, Westinghouse Electric & Mfg. Co., to Indiana Bridge Co., Muncie, Ind.

228 Tons, Chicago, 47th Street belt railway underpass for Cook County, to American Bridge Co., Pittsburgh.

203 Tons, Inkster, Mich., State highway bridge, to Bethlehem Steel Co., Bethlehem, Pa.

200 Tons, Chicago, elevated structure repairs for Chicago Rapid Transit Co., to Hansell-Elcock Co., Chicago.

102 Tons, Cleveland, structure for Cleveland Automatic Machine Co., to Burger Iron Works, Akron, Ohio.

WESTERN STATES

1570 Tons, Coram, Cal., Shasta Dam trash racks (Specification 1004), to Joseph T. Ryerson & Son, Inc., Chicago.

1200 Tons, Las Vegas, Nev., transmission towers for Basic Magnesium, Inc., to Emsco Derrick & Equipment Co., Los Angeles.

600 Tons, Pacific Coast points, underground storage tanks, to Western Pipe & Steel Co., San Francisco.

303 Tons, Odair, Wash., 27 gates for dam, to Mississippi Valley Structural Steel Co., St. Louis.

135 Tons, Boulder City, Nev., bridge for Department of Interior, to American Bridge Co., Pittsburgh.

PENDING STRUCTURAL STEEL PROJECTS
NORTH ATLANTIC STATES

2509 Tons, Sandy Hook, Md., Potomac River State bridge.

1310 Tons, Hartford, Conn., State viaduct superstructure.

1200 Tons, Absecom, N. J., bridge over thoroughfare, bids Dec. 12.

750 Tons, Tioga County, Pa., State highway bridge; bids Dec. 12.

634 Tons, Watervliet, N. Y., tank repair building for government.

540 Tons, Baltimore, machine shop extension for Maryland Dry Dock Co.

535 Tons, Newark, N. J., buildings for American Steel Castings Co.

530 Tons, Beaver Falls, Pa., buildings for Republic Steel Corp., Union Drawn Steel division.

325 Tons, Livingston County, N. Y., State highway bridge; bids Dec. 18.

190 Tons, Groton, Conn., State bridge over New York, New Haven & Hartford Railroad.

175 Tons, Montgomery County, N. Y., State highway bridge; bids Dec. 18.

148 Tons, Abington Township, Pa., State overpass, LR-151.

150 Tons, Camden, N. J., launching way girders for New York Shipbuilding Corp.

125 Tons, East Aurora, N. Y., State highway bridge; bids Dec. 18.

Unstated tonnage, Cheektowaga, N. Y., wind tunnel for Curtiss-Wright Corp., Airplane Division.

THE SOUTH

310 Tons, Ducktown, Tenn., power house, Ocoee No. 3, for TVA.

205 Tons, Lenoir City, Tenn., intake gates, Fort Loudoun Dam, for TVA.

CENTRAL STATES

153 Tons, Pike County, Ohio, Crooked Creek State bridge.

132 Tons, Middletown, Ohio, crane runway for Heckett Corp.

FABRICATED PLATES
AWARDS

1400 Tons, Pacific Coast points, underground storage tanks, to Western Pipe & Steel Co., San Francisco.

500 Tons, Tulsa, Okla., Ordnance Department, steel storage tanks for E. I. du Pont de Nemours powder plant, to Pittsburgh-Des Moines Steel Co., Pittsburgh.

456 Tons, Childersburg, Ala., pipe line for Alabama Ordnance Works, to Ingalls Iron Works Co., Birmingham, through Benjamin Shaw, Sylacauga, Ala.

PENDING PROJECTS

135 Tons, Olympia, Wash., storage tanks.

135 Tons, Martinez, Cal., storage tanks.

100 Tons, Pacific Islands, hydro-pneumatic tanks.

Reinforcing Steel

Awards of 8600 tons; 13,900 tons in new projects.

AWARDS
ATLANTIC STATES

1300 Tons, Pennsylvania, highway projects in five counties, roads and bridges, to Bethlehem Steel Co., Bethlehem, Pa.

1800 Tons, Pottstown, Pa., Jacobs Aircraft Engine Co., to Bethlehem Steel Co., Bethlehem, Pa.

200 Tons, Brooklyn Navy Yard, ordnance machine shop, to Truscon Steel Co., Youngstown, through John Lowrey, Inc., contractor.

100 Tons, Philadelphia Navy Yard, turbine testing building, to Bethlehem Steel Co., Bethlehem, Pa.; Charles F. Vachris, contractor.

THE SOUTH

400 Tons, Arlington, Va., bridge for War Department building, to Truscon Steel Co., Youngstown, through Cayuga Construction Co.

436 Tons, Georgia, motor repair building for Army Depot, to Truscon Steel Co., Youngstown, through Central Contracting Co.

249 Tons, Jacksonville, Ark., ordnance plant, to Truscon Steel Co., Youngstown, through Ford, Bacon & Davis Co.

155 Tons, State of Kentucky, highway at Benton, to Truscon Steel Co., Youngstown, through Hart & Hart, contractors.

217 Tons, Keithville, La., State highway, to Truscon Steel Co., Youngstown, through Louisiana Metal Culvert Co.

200 Tons, Newport News, Va., municipal filtration plant, to Bethlehem Steel Co., Bethlehem, Pa.; Bass Engineering Co., contractor.

105 Tons, Nahunta, Ga., State highway, to Truscon Steel Co., Youngstown, through Waines Co.

CENTRAL STATES

352 Tons, Terre Haute, Ind., Bureau of Prisons, to Truscon Steel Co., Youngstown.

350 Tons, Pontiac, Mich., Pontiac gun plant, to Truscon Steel Co., Youngstown.

207 Tons, Highland Park, Mich., Third Avenue viaduct, to Truscon Steel Co., Youngstown.

125 Tons, Cincinnati, Invitation No. 6845-88, for city, to Pollak Steel Co.

WESTERN STATES

1800 Tons, Coram, Cal., Bureau of Reclamation, Invitation A-33457-A-1; 1050 tons to Youngstown Sheet & Tube Co., Youngstown, and 750 tons to Inland Steel Co., Chicago.

474 Tons, San Diego, Cal., vehicular overpass for Consolidated Aircraft, to Truscon Steel Co., Youngstown; V. O. Larson, general contractor.

109 Tons, San Diego, Cal., expansion at Naval Station, to Truscon Steel Co., Youngstown, through J. Harvey Chambers Co.

PENDING REINFORCING BAR PROJECTS
ATLANTIC STATES

7850 Tons, Brooklyn Navy Yard, Invitation No. K-16; bids taken Dec. 8.

477 Tons, Lincoln, R. I., State bridge; previously reported as 150 tons.

400 Tons, Atlantic City, N. J., Beach Thorofare bridge; bids Dec. 12.

400 Tons, Baltimore, Maryland Dry Dock Co. pier and wharf; bids taken Dec. 8.

300 Tons, Carderock, Md., Naval wind tunnel building; bids taken.

240 Tons, Sandy Hook, Md., superstructure, Potomac River bridge; bids Dec. 16.

125 Tons, Watertown, Mass., arsenal building No. 41 heat treating unit.

CENTRAL STATES

400 Tons, Wright Field, Ohio, administration engineers building.

300 Tons, East Chicago, Ind., Great Lakes Carbon Co.

250 Tons, St. Paul, Minn., Northern States Power Co.; bids Dec. 26.

200 Tons, Manitowoc, Wis., Manitowoc County Asylum.

100 Tons, Rock Island, Ill., Rock Island telephone exchange.

WESTERN STATES

1500 Tons, Coram, Cal., Shasta Dam (Invitation A-33,457-A-5); bids taken.

CANAL ZONE

1468 Tons, Panama Canal, Schedules Nos. 5772, and 5757; bids taken.

Cast Iron Pipe

Water Department, Macon, Ga., plans pipe line extensions in water system and other waterworks installation. Cost about $250,000. Proposed to ask bids before close of month. Wiedeman & Singleton, Candler Building, Atlanta, Ga., are consulting engineers.

Quartermaster, Camp Davis, N. C., asks bids until Dec. 15 for 850 ft. of cast iron soil pipe; also for brass gate valves, etc. (Circular 273-71).

Bloomingburg, Ohio, plans pipe lines for water system and other waterworks installation, including 100,000-gal. elevated steel tank and tower. Financing is being arranged. Paul Elwell, 5005 Euclid Avenue, Cleveland, is consulting engineer.

Washington Suburban Sanitary Commission, Hyattsville, Md., plans pipe line extensions in water system at Forrestville and other waterworks installation. Cost about $88,260. Also will make extensions in water pipe line system at Cabin John Park and vicinity, Montgomery Park. Cost close to $66,800. This is part of expansion and improvements to be made in water and sewage system in different districts to cost about $1,000,000. Bond issue in that amount is being arranged.

Dawson, Okla., plans pipe lines for water system and other waterworks installation. Cost about $33,000. Financing is being arranged through Federal aid. Craig & Wood, Philtower Building, Tulsa, Okla., are consulting engineers.

Defense Public Works Office, Seattle, will take bids soon for construction of fourth unit, Fort Lewis area water system, involving 11,000 ft. of 2-in., 54,000 ft. of 4-in., 80,000 ft. of 6-in., 28,000 ft. of 8-in., 10,000 ft. of 10-in., 15,000 ft. of 12-in. pipe and accessories.

Pipe Lines

Continental Oil Co., Ponca City, Okla., plans new 4-in. welded steel pipe line from gas field properties at Navina, Okla., to Edmond, Okla., about six miles, for natural gas transmission to company compressor station at latter place, for use in connection with natural gasoline production.

Morgan City, La., has approved bond issue of $264,000 for pressure pipe line system for municipal natural gas distribution, including main welded steel pipe line from Bateman Lake gas field, near Berwick, source of supply, to city limits, with control station, meter house and other operating facilities. T. Baker Smith, Houma, La., is consulting engineer.

Oklahoma Natural Gas Co., 624 South Boston Street, Tulsa, Okla., is arranging fund of about $1,410,000 for expansion and improvements in system and facilities in 1942, of which approximately $550,000 will be used for new welded steel pipe line extensions and replacements in main transmission lines; close to $600,000 for pressure pipe line extensions in distribution systems at different points; $150,000 for increasing gas reserves, and remainder of appropriation for miscellaneous work.

Metropolitan District, Board of Contract and Supply, Municipal Building, 550 Main Street, Hartford, Conn., asks bids until Dec. 22 for about one mile of pressure pipe for water supply from connection with pipe line in Canal Road to point on Mountain Road and thence along that thoroughfare to connection with pipe line in Fern Street. Alternate bids will be received on 31½-in. electrically-welded steel pipe, double-dipped in asphalt enamel; and 30-in. reinforced-concrete cylinder pipe. Plans at office of Water Bureau, 1026 Main Street.

United Gas Pipe Line Co., Shreveport, La., plans three submarine pipe lines for natural gas transmission, comprising two parallel lines, about 100 ft. apart, approximately three feet below bed of Pascagoula River, near Vancleave, Miss.; and pipe line across Smith Lake, a tributary of river noted, near Moss Point, Miss. Also will extend pipe lines from shore points of these new lines to connection with main transmission system.

North Western Utilities, Ltd., Edmonton, Alta., plans extension of about seven miles in main welded steel pipe line for natural gas transmission to terminus at that point. Cost over $70,000 with operating facilities.

Oil Industry Suppliers Given A-8 Rating

Washington

• • • **OPM's Priorities** Division on Monday assigned supply houses furnishing materials and equipment to the petroleum industry a preference rating of A-8 on their orders of specified quantities of materials by preference rating Order No. P-83. The order covers materials to be used in the discovery and development of new oil wells, in addition to materials for maintenance and operation.

Weekly Bookings of Construction Steel

Week Ended →	Dec. 9, 1941	Dec. 2, 1941	Nov. 11, 1941	Dec. 10, 1940	Year to Date 1941	Year to Date 1940
Fabricated structural steel awards	16,400	14,450	44,450	18,800	1,246,770	1,093,260
Fabricated plate awards	2,355	0	5,465	815	139,200	142,945
Sheet steel piling awards	0	0	0	250	26,760	65,630
Reinforcing bar awards	8,600	6,400	19,800	10,700	679,655	453,195
Total letting of Construction Steel	27,355	20,850	69,715	30,565	2,092,385	1,755,030

MACHINE TOOLS

. . . SALES, INQUIRIES AND MARKET NEWS

Press Orders Expected For Steel Shell Casings

Cleveland

• • • **Manufacturers of heavy presses** may be in line for some important orders of such equipment for use in stamping out steel casings for shells, on the basis of various reports circulating in Cleveland. It is rumored that at least two Cleveland concerns and at least one Cincinnati plant have received experimental orders for steel cartridge cases, with the prospect that wider use of steel may be made for this munitions purpose to replace the copper hitherto required in brass casings. (See THE IRON AGE, Nov. 6, p. 113).

Recent experiments are reported to indicate that steel shell casings can be successfully used over about 20 times, as against about four times for brass casings. Moreover, the steel casing is said to be able to withstand 10,000 lb. more pressure per sq. in. than the brass casing.

Machine tools either being shipped or on order for Russia are reported to include horizontal boring mills, turret lathes, radial drills and several other items.

Price Controls Still Pending

Cincinnati

• • • **While there have been** no new developments along the line of a possible price ceiling on new machine tools, district machine tool manufacturers do not doubt that the possibility of such a Washington order is likely. Recent conferences brought forth suggestions of a wide variety, all of which have been taken into consideration by OPA officials. While no specified time for further conferences has been announced, it is anticipated that additional meetings with representatives of the trade in Washington will be conducted before any order is issued. In the meantime, steady expansion of the demand is seen, with a corresponding zealous effort on the part of manufacturers to accommodate the increased ordering. Virtually all manufacturers report that the new business coming in and available, has not yet reached the peak, as further flurries were noted as expansion of the tank program was announced.

60% of W. & S. Orders Have A-1-a Priority

Cleveland

• • • **The Warner & Swasey Co.,** machine tool builder, reports that 60 per cent of its present six months' backlog consists of orders with A-1-a priorities. The company also revealed that its expansion program by May 1942 will permit a 30 per cent balanced increase right along the line in the company's output over the amount of machines turned out in October, 1941. Besides increasing the company's facilities to machine heavy castings like machine beds and adding space for assembling the finished product, the company states that a portion of the over all production increase may be attributed to the successful subcontracting of various small operations to balance in with equipment expansion in certain divisions.

Based upon the rate of incoming orders, it appears that the company may be able to reduce its backlog by the latter part of the first quarter of 1942, provided the relationship of the industry to the war program is not again radically changed.

NON-FERROUS METALS

. . . MARKET ACTIVITIES AND PRICE TRENDS

War Risks Rates Up On Pacific Shipments

• • • **The eyes of** the non-ferrous industry this week turned to the war in the Pacific, since large imports of refined and crude non-ferrous metals come from that direction. Tin, tungsten, lead, nickel, copper, chromium, and many other commodities, in varying quantities, essential to our defense program cross the Pacific from Australia, China, India, Netherlands East Indies, and other Far East points. The trade is apprehensive about future imports.

Marine underwriters last week announced revisions in cargo war risk rates between United States and the East and Far East, increasing rates from 1 to 1¾ per cent. This increase in rates adds about 40c. a 100 lb. to the cost of importing tin, and forces the price importers can pay for tin lower in the face of a market that at present is too high for importers to participate in.

The International Tin Committee announced the acceptance of a 5-year extension of the International Constriction Scheme by five of the seven major tin producing countries. The proposed production standards for these countries are:

	tons	*per cent*
Congo	20,178	8.03
Bolivia	46,768	18.60
Malaya	95,474	37.98
Neth. East Indies	55,113	21.92
Nigeria	15.367	6.11
Thailand (Siam)	18,500	7.36
	251,400	100.00

Thailand refused to sign the extension agreement on the basis of its quota, but developments indicate that it was probably at the pressure of the Japanese that the refusal was made. For the same reason, French Indo-China was not included in the five-year pact. The proposed standards are set for an annual production of 44,430 tons greater than the present

Public hearings will begin tomorrow for the OPM to determine copper production potentials, it was reported this week. Chester C. Davis, president of the St. Louis Federal Reserve Bank, has been chosen chairman of the investigations. These hearings, ordered by the SPAB in response to criticism voiced in Congress and elsewhere on the restriction of use placed upon copper by OPM, will duplicate to some extent the investigations of the Truman Senate Committee, scheduled to begin hearings Dec. 9. Chief counsel for the Truman Senate Committee has begun collection of data already, having sent telegrams to all copper producers requesting production data. The Senate committee is expected to delve into priorities and shortages, while the SPAB will probe the matter of higher production of copper. Allocation certificates are expected to be issued this week covering December copper shipments.

Slab zinc production in November totaled 74,710 tons, off 1270 tons from October production, but a new daily rate record of 2490 tons was established.

Non-Ferrous Prices

(Cents per lb. for early delivery)

Copper, Electrolytic[1]	12.00
Copper, Lake	12.00
Tin, Straits, New York	52.00
Zinc, East St. Louis[2]	8.25
Lead, St. Louis[3]	5.70

[1] Mine producers' quotations only, delivered Conn. Valley. Deduct ¼c. for approximate New York delivery price. [2] Add 0.39c. for New York delivery. [3] Add 0.15c. for New York delivery.

Miscellaneous Non-Ferrous Prices

ALUMINUM, delivered: virgin, 99 per cent plus, 15c.-16c. a lb.; No. 12 remelt No. 2, standard, 14.50c. a lb. NICKEL electrolytic, 35c.-36c. a lb. base refinery, lots of 2 tons or more. ANTIMONY, prompt; Asiatic, 16.50c. a lb., New York; American, 13c. a lb., f.o.b. smelter. QUICKSILVER, $199 per flask of 76 lb. BRASS INGOTS, commercial 85-5-5-5, 13.25c. a lb.

SCRAP

. . . MARKET ACTIVITIES AND PRICE TRENDS

Changes Mapped In Classifications

• • • **At a fifth meeting** today (Thursday) with buyers and sellers of iron and steel scrap, OPM is expected to complete its study toward elimination of several loopholes which have existed in grade classifications. No general change in prices is expected as the conversation has all centered around simplification of grades, except for recognition that higher freight rates are likely to result from the railroad wage increases.

The result, which is expected to be announced soon because the continued meetings are creating an unsettled feeling in scrap circles, will benefit some market interests in certain respects while others will suffer a little. Undoubtedly the number of low phos grades will be cut down, bundles will be defined more accurately, and billet and bloom crops may be reclassified.

In addition to the expected changes in the steel mill grades, the foundry grade setup is likely to be revised. Several new classifications may be added. The dearth of scrap rails for foundry use is a factor responsible for some of the proposed changes.

Story on Relaying Rail setup appears on page **109.**

Leon Henderson said Monday that "satisfaction with the present level of prices has been expressed by buyers and sellers at a series of meetings with OPA. Among matters under consideration are possibility of higher freight rates; problems of allocation; simplification of a few features of the grade structure, and methods of directing the flow into most suitable channels."

Capital Iron & Metal Co., and Pioneer Iron & Metal Co., both of Oklahoma City, Okla., were cited publicly by Henderson as "frequent and persistent" violators of the price schedule. When invited to Washington to explain the transactions, they did not come in person, but were represented by an attorney and an auditor through whom

Declaration of War New Spur for Task

• • • The outbreak of war with Japan early this week inspired scrap collectors and dealers from coast to coast with new zeal for their vital task in the national emergency.

"Japan's action has united the United States," said one dealer in the East. "We are putting our shoulder to the wheel. Differences of opinion must be forgotten."

Boston Meeting Acts To Seek Price Boost

Boston

• • • At a joint meeting of the Boston and southern New England chapters of the Scrap Institute in Boston, Dec. 4, it was decided to appoint a committee to visit Washington for the purpose of obtaining higher prices for scrap. What the trade in general desires is an f.o.b. price on scrap. Such a price it is felt would simplify the whole scrap situation and would materially reduce the cost of government regulation of scrap.

they admitted the violations, he said, and they refused to make restitution, or to agree to comply with the schedule.

Henderson also reported OPA has been notified of several abuses which threaten to disturb operation of the price schedule. The abuses include "trading" of prime and second grade steel products for scrap; reciprocal purchase agreements; tying arrangements; and certain forms of by-passing of customary dealer-broker-consumer relationships.

An intensive inquiry into costs of dealers in the Chicago regional area was reported under way last week by OPA.

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PITTSBURGH—With the country at war, the scrap situation appears to be more ominous than before. Supplies continue tight and brokers are having difficulty filling commitments. Outright allocations by the government may soon begin on the basis of the per cent of defense business held by consumers.

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DETROIT—Sales increased here Monday. No explanation was forthcoming, except that possibly the war might have overcome the lethargy that existed.

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CLEVELAND—Hardships upon scrap dealers in Central and Northwest Ohio, caused by the price system, are noted. Since the Detroit price is currently $17.85 per gross ton for No. 1, with freight of $1.52 per ton deducted Toledo dealers must sell their scrap for a net price of $16.33 per ton. Yet, in selling Canton consumers, the dealers would be forced to take a sacrifice of 75c. per gross ton by making shipments to such a point.

•

BUFFALO—Three more boats carrying about 15,000 tons from the Duluth area docked here last week. This boosts to 70,000 tons the scrap unloaded in the last six weeks, 65,000 of which went to Bethlehem-Lackawanna and 5000 to Republic Steel here. Wickwire Spencer received a substantial shipment by barge from Cuba.

BIRMINGHAM—The feeble flow of scrap shows further slackening. Some stock piles are at record lows.

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CINCINNATI—The market is unchanged. Foundries continue crippled by the rapidly diminishing scrap flow.

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ST. LOUIS—The local chapter of the Institute met Tuesday afternoon to discuss means of meeting the expected increased demand for scrap caused by the war. Mills continue to operate without loss of time but the scrap situation continues acute. Three railroads in the district issue lists offering small lots.

BOSTON—Certain kinds of auto scrap are coming out a little more freely. Tire rims bring around $19 to $20 a ton delivered. Connecticut is reported to have an abundance of auto scrap, but small quantities in other New England states have been cleaned up. Many melters are willing to take No. 2 for No. 1 steel at the No. 1 price.

•

NEW YORK—Dealers are mourning the loss of another source of supply. Steel mills were awarded practically all the Navy yard scrap last week, the bulk going to Bethlehem and lesser amounts to smaller Eastern mills.

Iron and Steel Scrap (other than railroad scrap)

(Maximum basing point prices as revised by OPA to Nov. 25, 1941, from which shipping point prices and consumers' delivered prices are to be computed, per gross ton)

Basing Points → / ▼ GRADES	Pittsburgh	Johnstown Wairton Steubenville Youngstown Warren Sharon Canton	Chicago	Kokomo	Bethlehem	Claymont Coatesville Phoenixville Harrisburg Conshohock'n	Sparrows Point	Buffalo	Cleveland	Toledo	Cincinnati* Portsmouth Middletown Ashland	St. Louis†††	Detroit	Duluth Min'apolis**	Alabama City† Atlanta†† Birmingham	Chattanooga	Radford, Va	Worcester Bridgeport Philipsdale, R. I.	Seattle	Los Angeles San Fr'co*** Pittsb'g, Cal.	M'nequa, Colo. Portland, Ore.
No. 1 heavy melting	$20.00	$20.00	$18.75	$18.25	$18.25	$18.75	$18.75	$19.25	$19.50	.....	$19.50	$17.50	$17.85	$18.00	$17.00	.....	.....	.....	$14.50	$17.00	16.50
No. 1 hyd. comp. black sheet	20.00	20.00	18.75	18.25	18.25	18.75	18.75	19.25	19.50	.....	19.50	17.50	17.85	18.00	17.00	.....	.....	.....	14.50	17.00	16.50
No. 2 heavy melting	19.00	19.00	17.75	17.25	17.25	17.75	17.75	18.25	18.50	.....	18.50	16.50	16.85	17.00	16.00	.....	.....	(See	13.50	16.00	15.50
Dealers' No. 1 bundles	19.00	19.00	17.75	17.25	17.25	17.75	17.75	18.25	18.50	.....	18.50	16.50	16.85	17.00	16.00	.....	.....	foot-	13.50	16.00	15.50
Dealers' No. 2 bundles	18.00	18.00	16.75	16.25	16.25	16.75	16.75	17.25	17.50	.....	17.50	15.50	15.85	16.00	15.00	.....	.....	notes)	12.50	15.00	14.50
Mixed borings and turnings	15.25	15.25	14.00	14.25	13.50	14.00	14.00	14.50	14.75	13.10	14.75	12.75	13.10	.....	12.25	.....	.....	.....	9.75	12.25	11.75
Machine shop turnings	15.50	15.50	14.25	14.50	13.75	14.25	14.25	14.75	15.00	13.35	15.00	13.00	13.35	15.50	15.00	Alloy, ...	W.Va. 17.60	.....	10.00	12.50	12.00
Shoveling turnings	16.50	16.50	15.25	15.50	14.75	15.25	15.25	15.75	16.00	14.35	16.00	14.00	14.35	16.50	16.00	.....	.....	.....	11.00	13.50	13.00
No. 1 busheling	19.50	19.50	18.25	17.75	17.75	18.25	18.25	18.75	19.00	.....	19.00	17.00	17.35	17.50	16.50	.....	.....	.....	14.00	16.50	16.00
No. 2 busheling	15.50	15.50	14.25	13.75	13.75	14.25	14.25	14.75	15.00	.....	15.00	13.00	13.35	13.50	12.50	.....	.....	.....	10.00	12.50	12.00
Cast iron borings	15.75	15.75	14.50	14.00	14.00	14.50	14.50	15.00	15.25	13.60	§15.25	13.25	13.60	13.75	12.75	.....	.....	.....	10.25	12.75	12.25
Uncut structural, plate scrap	19.00	19.00	17.75	17.25	17.25	17.75	17.75	18.25	18.50	.....	18.50	16.50	16.85	17.00	16.00	.....	.....	.....	13.50	16.00	15.50
No. 1 cupola	21.00	21.00	20.00	20.00	22.50	23.00	22.00	20.00	22.00	.....	21.00	20.00	20.35	19.00	20.00	20.50	21.00	22.00	18.00	19.50	18.00
Heavy breakable cast	19.50	19.50	18.50	18.50	21.00	21.50	21.00	18.50	20.50	.....	19.50	18.50	18.85	17.50	18.50	19.00	19.50	20.50	17.00	18.00	16.50
Stove plate	19.00	§19.00	17.00	16.00	18.00	18.50	18.00	19.00	18.00	15.60	17.50	17.00	14.10	16.00	17.00	17.50	18.00	17.50	14.00	16.50	15.00
Low phos. billet, bloom crops	25.00	25.00	23.75	23.75	23.25	23.75	23.75	24.25	24.50	.....	24.50	22.50	22.85	23.00	22.00	.....	.....	.....	19.50	22.00	20.50
Low phos. bar crops, smaller	23.00	23.00	21.75	21.75	21.25	21.75	21.75	22.25	22.50	.....	22.50	20.50	20.85	21.00	20.00	.....	.....	.....	19.50	20.00	18.50
Low phos. pu'ch'gs, plate scrap[1]	24.75	23.00	21.75	21.75	21.25	21.75	21.75	22.25	22.50	.....	22.50	20.50	20.85	21.00	20.00	.....	.....	.....	17.50	20.00	18.50
Machinery cast, cupola size[2]	22.00	22.00	21.00	21.00	23.50	24.00	23.50	21.00	23.00	.....	22.00	21.00	21.35	20.00	21.00	21.50	22.00	23.00	19.00	20.50	19.00
No. 1 mach. cast, drop-broken, 150 lb. and under	22.50	22.50	21.50	21.50	24.00	24.50	24.00	21.50	23.50	.....	22.50	21.50	21.85	20.50	21.50	22.00	22.50	23.50	19.50	21.00	19.50
Clean auto cast	22.50	22.50	21.50	21.50	24.00	24.50	24.00	21.50	23.50	.....	22.50	21.50	21.85	20.50	21.50	22.00	22.50	23.50	19.50	21.00	19.50
Punchings and plate scrap[3]	23.75	22.00	20.75	20.75	20.25	20.75	20.75	21.25	21.50	.....	21.50	19.50	19.85	20.00	19.00	.....	.....	.....	16.50	19.00	17.50
Punchings and plate scrap[4]	22.75	21.00	19.75	19.75	19.25	19.75	19.75	20.25	20.50	.....	20.50	18.50	18.85	19.00	18.00	.....	.....	.....	15.50	18.00	16.50
Heavy axle, forge turnings	21.25	19.50	18.25	18.25	17.75	18.25	18.25	18.75	19.00	.....	19.00	17.00	17.35	17.50	16.50	.....	.....	.....	14.00	16.50	15.00
Medium h'vy el f'ce turnings	19.75	18.00	16.75	16.75	16.25	16.75	16.75	17.25	17.50	.....	17.50	15.50	15.85	16.00	15.00	.....	.....	.....	12.50	15.00	13.50

[1] This grade is ⅜-in. and heavier, cut 12 in. and under. [2] May include clean agricultural cast. [3] Under ⅜ to ¼-in., cut 12 in. and under. [4] Under ¼-in. to No. 12 gage, cut 12 in. and under. [5] Youngstown, Warren, Sharon and Canton are not basing points on this grade. [6] Middletown and Cincinnati price for this grade is $15. * Includes Newport, Ky. Shipping point price within Cincinnati basing point may be 80c. a ton below basing point price listed above for all grades except the six cast grades. ** Minneapolis and St. Paul are basing points on following grades only: No. 1 cupola, heavy breakable cast, stove plate, machinery cast cupola size, No. 1 machinery cast drop broken, clean auto cast. † Alabama City, Ala., is basing point only on No. 1 heavy melting; No. 1 compressed black sheets; No. 2 heavy melting; dealers' No. 1 and No. 2 bundles, mixed borings and turnings; machine shop turnings; shoveling turnings; No. 1 and No. 2 busheling; cast iron borings; uncut structural and plate scrap. †† Atlanta is basing point only on No. 1 and No. 2 heavy melting; No. 1 compressed black sheets; No. 1 and No. 2 dealers' bundles. ††† St. Louis basing point includes the switching district of Granite City, East St. Louis, and Madison, Ill. *** The San Francisco basing point includes the switching districts of South San Francisco, Niles and Oakland.

Railroad Scrap *(Per gross ton, delivered consumers' plants located on line of railroad originating scrap)*

Basing Points → / ▼ GRADES	Pittsburgh Sharon, Pa. Wheeling Steubenville Youngstown Canton	Chicago	Kokomo	Philadelphia	Wilmington	Sparrows Point	Cleveland	Buffalo	Portsmouth Middletown Ashland	St. Louis	Kansas City	Cincinnati	Detroit	Duluth	Birmingham	Seattle	Los Angeles San Francisco
No. 1 heavy melting	$21.00	$19.75	$19.25	$19.75	$19.75	$19.75	$20.50	$20.25	$20.50	$18.50	$17.00	$20.50	$18.85	$19.00	$18.00	$15.50	18.00
Scrap rails	22.00	20.75	20.25	20.75	20.75	20.75	21.50	21.25	21.50	19.50	18.00	21.50	19.85	20.00	19.00	16.50	19.00
Rerolling rails	23.50	22.25	21.75	22.25	22.25	22.25	23.00	22.75	23.00	21.00	19.50	23.00	21.35	21.50	20.50	18.00	20.50
Scrap rails 3 ft. and under	24.00	22.75	22.25	22.75	22.75	22.75	23.50	23.25	23.50	21.50	20.00	23.50	21.85	22.00	21.00	18.50	21.00
Scrap rails 2 ft. and under	24.25	23.00	22.50	23.00	23.00	23.00	23.75	23.50	23.75	21.75	20.25	27.75	22.10	22.25	21.25	18.75	21.25
Scrap rails 18 in. and under	24.50	23.25	22.75	23.25	23.25	23.25	24.00	23.75	24.00	22.00	20.50	24.00	22.35	22.50	21.50	19.00	21.50

Railroads not operating in a basing point may sell rerolling rails f.o.b. their lines at average price of their sales from Sept. 1, 1940, to Jan. 31, 1941. Rerolling mills may absorb all transportation charges necessary to obtain such rails. Maximum prices for scrap rails and rerolling rails from mines, logging camps and similar sources need not be sold for less than $13.50 a gross ton for scrap rails and $15 for rerolling material at shipping point.

Where the railroad originator of the scrap operates in two or more of the basing points named, the highest of the maximum prices established for such basing points shall be the maximum price of the scrap delivered to a consumer's plant at any point on the railroad's line, except that switching charges of 84c. per gross ton shall be subtracted from the maximum prices of scrap originating from railroads operating in Chicago and sold for consumption outside Chicago.

Explanatory Notes

(A basing point includes its switching district)

MAXIMUM PRICE at which any grade of scrap may be delivered to consumer's plant, wherever located, is the shipping point price, plus actual transportation from the shipping point to consumer. Where shipment is by water, actual handling charges at the dock of not more than 75c. a gross ton may be included as part of transportation charges. In no case may this maximum price exceed by more than $1 prices (for material other than railroad scrap) for the basing point nearest the consumer.

COMPUTING SHIPPING POINT PRICE: A shipping point is the point from which the scrap is to be shipped to a consumer. A shipping point price is computed as follows: (a) For Shipping Points located within a basing point.—The price established for the basing point in which the shipping point is located, is determined. Then deduct from this the actual costs involved in transporting scrap from the shipping point to the consumer's plant within the basing point which is nearest, in terms of transportation costs, to the shipping point; (b) For shipping points located outside a basing point.—The price established for the nearest basing point, in terms of transportation charges, to the shipping point is determined. Deduct from this the lowest established charge for transporting scrap from the shipping point to such basing point. *Exceptions:* (1) The shipping point price at any shipping point in New England, of those grades of scrap for which no prices are listed above shall be the Johnstown basing point price, minus the all-rail transportation costs from the New England shipping point to Johnstown; (2) Shipping point prices for New York City, Brooklyn, New York, and New Jersey shall be computed from the Bethtlehem, Pa., basing point.

GULF PORT PRICES: Scrap shipped from Tampa, Pensacola, Gulfport, Mobile, New Orleans, Lake Charles, Port Arthur, Beaumont, Galveston, Texas City, Houston and Corpus Christi, has a maximum shipping point price not exceeding $14 a gross ton, f.o.b. cars, for No. 1 heavy melting steel. For other grades, the differentials established for Birmingham apply.

REMOTE SCRAP: Defined as all grades of scrap listed in table above (exclusive of railroad scrap) located in Florida, Montana, Idaho, Wyoming, Nevada, Arizona, New Mexico, Texas and Oklahoma. Maximum shipping point price of remote scrap is $12 a gross ton, for No. 2 heavy melting steel, with differentials for other grades the same as differentials established in table above for St. Louis. The maximum delivered price of remote scrap is the shipping point price, plus actual transportation charges, except that when necessary to absorb transportation charges, the maximum delivered price may be exceeded by a maximum of $4 a ton. Thus the maximum delivered price for remote scrap may exceed the price for the nearest basing point by $5. In the event that an allowance in excess of $5 a ton is necessary to acquire a tonnage of remote scrap, a consumer may apply to OPA for permission to exceed the $5 allowance. Purchases under these remote scrap provisions must be for not less than one car a month and must be reported in detail. Provisions of this remote scrap section expire Dec. 31, 1941.

BROKER COMMISSIONS: A commission of up to 50c. a ton above the maximum prices is allowed to brokers.

*OPA maximum for sale by dealer. **Nominal.

UNPREPARED SCRAP: Regardless of source, maximum price of unprepared scrap is $2.50 less than maximum for corresponding grade of prepared scrap.

BILLET AND BLOOM CROPS: Where such material originates in the Pittsburgh basing point, it may be sold delivered to a consumer within or without the Pittsburgh point at the price given in Schedule 'A, plus not more than $2.50 in transportation charges. Lowest established transportation charges will govern.

Non-Ferrous Scrap

(Dealers buying prices, cents per lb.)

	New York	Philadelphia	Pittsburgh	Cleveland	Detroit	Chicago
No. 1 hvy. copper	*10.00	*10.00	*10.00	*10.00	*10.00	*10.00
Light copper	* 8.00	* 8.00	* 8.00	* 8.00	* 8.00	* 8.00
Hvy. yel. brass	6.25-6.50	**6.25	7.50-8.00	5.75 6.25	7.00 7.25	7.50
Light brass	* 5.25-5.50	**5.50	7.00-7.25	6.00-6.50	6.50-6.75	7.00 7.25
No. 1 Comp. turn.	8.75-9.00	**7.75	**9.00-9.25	8.50-9.00	9.00-9.25	9.00 9.25
New brass clips	8.00-8.25	8.50-9.00	7.75-8.00	8.00-8.50	7.50-8.00	7.75-8.25
Soft lead	5.25-5.50	5.00-5.25	4.75-5.00	4.75-5.00	5.00-5.25	4.75-5.00
Old zinc	4.00-4.25	4.25	4.25-4.50	4.00-4.50	4.25-4.50	4.50-5.00
Cast, forged alum.	*11.00	*11.00	*11.00	*11.00	*11.00	*11.00
Old sheet alum.	*11.00	*11.00	*11.00	*11.00	*11.00	*11.00
Solder joints	8.75-9.00	9.00	7.50-8.00	6.50-6.75	5.50-6.00	7.50-8.00
No. 1 pewter	35.00-36.00	35.00-36.00	31.00-32.00	32.50-34.00	37.50-38.50	32.80-34.00

* OPA maximum for sale by dealer. ** Nominal.

. . . Comparison of Prices

(Advances Over Past Week in **Heavy Type**; Declines in *Italics*)

(Prices Are F.O.B. Major Basing Points)

	Dec. 9, 1941	Dec. 2, 1941	Nov. 11, 1941	Dec. 10, 1940
Flat Rolled Steel:				
(Cents Per Lb.)				
Hot rolled sheets	2.10	2.10	2.10	2.10
Cold rolled sheets	3.05	3.05	3.05	3.05
Galvanized sheets (24 ga.)	3.50	3.50	3.50	3.50
Hot rolled strip	2.10	2.10	2.10	2.10
Cold rolled strip	2.80	2.80	2.80	2.80
Plates	2.10	2.10	2.10	2.10
Stain's c. r. strip (No. 302)	28.00	28.00	28.00	28.00
Tin and Terne Plate:				
(Dollars Per Base Box)				
Tin plate	$5.00	$5.00	$5.00	$5.00
Manufacturing ternes	4.30	4.30	4.30	4.30
Bars and Shapes:				
(Cents Per Lb.)				
Merchant bars	2.15	2.15	2.15	2.15
Cold finished bars	2.65	2.65	2.65	2.65
Alloy bars	2.70	2.70	2.70	2.70
Structural shapes	2.10	2.10	2.10	2.10
Stainless bars (No. 302)	24.00	24.00	24.00	24.00
Wire and Wire Products:				
(Cents Per Lb.)				
Plain wire	2.60	2.60	2.60	2.60
Wire nails	2.55	2.55	2.55	2.55
Rails:				
(Dollars Per Gross Ton)				
Heavy rails	$40.00	$40.00	$40.00	$40.00
Light rails	40.00	40.00	40.00	40.00
Semi-Finished Steel:				
(Dollars Per Gross Ton)				
Rerolling billets	$34.00	$34.00	$34.00	$34.00
Sheet bars	34.00	34.00	34.00	34.00
Slabs	34.00	34.00	34.00	34.00
Forging billets	40.00	40.00	40.00	40.00
Alloy blooms, billets, slabs	54.00	54.00	54.00	54.00
Wire Rods and Skelp:				
(Cents Per Lb.)				
Wire rods	2.00	2.00	2.00	2.00
Skelp (grvd)	1.90	1.90	1.90	1.90

	Dec. 9, 1941	Dec. 2, 1941	Nov. 11, 1941	Dec. 10, 1940
Pig Iron:				
(Per Gross Ton)				
No. 2 fdy., Philadelphia	$25.84	$25.84	$25.84	$25.84
No. 2, Valley furnace	24.00	24.00	24.00	23.00
No. 2, Southern Cin'ti	24.06	24.06	24.06	23.06
No. 2, Birmingham	20.38	20.38	20.38	19.38
No. 2, foundry, Chicago†	24.00	24.00	24.00	23.00
Basic, del'd eastern Pa.	25.34	25.34	25.34	24.34
Basic, Valley furnace	23.50	23.50	23.50	22.50
Malleable, Chicago†	24.00	24.00	24.00	23.00
Malleable, Valley	24.00	24.00	24.00	23.00
L. S. Charcoal, Chicago	31.34	31.34	31.34	30.34
Ferromanganese‡	120.00	120.00	120.00	120.00

†The switching charge for delivery to foundries in the Chicago district is 60c. per ton. ‡For carlots at seaboard.

Scrap:				
(Per Gross Ton)				
Henvy melt'g steel, P'gh.	$20.00	$20.00	$20.00	$22.75
Henvy melt'g steel, Phila.	18.75	18.75	18.75	20.75
Heavy melt'g steel, Ch'go	18.75	18.75	18.75	20.50
No. 1 hy. comp. sheet, Det.	17.85	17.85	17.85	19.00
Low phos. plate, Youngs'n	23.00	23.00	23.00	26.00
No. 1 cast, Pittsburgh	22.00	22.00	22.00	22.75
No. 1 cast, Philadelphia	24.00	24.00	24.00	23.25
No. 1 cast, Ch'go*	21.00	21.00	21.00	19.25

*Changed to gross ton basis, April 3, 1941.

Coke, Connellsville:				
(Per Net Ton at Oven)				
Furnace coke, prompt	$6.125	$6.125	$6.125	$5.25
Foundry coke, prompt	6.875	6.875	6.875	5.75
Non-Ferrous Metals:				
(Cents per Lb. to Large Buyers)				
Copper, electro., Conn.*	12.00	12.00	12.00	12.00
Copper, Lake, New York	12.00	12.00	12.00	12.00
Tin (Straits), New York	52.00	52.00	52.00	50.10
Zinc, East St. Louis	8.25	8.25	8.25	7.25
Lead, St. Louis	5.70	5.70	5.70	5.35
Antimony (Asiatic), N. Y.	16.50	16.50	16.50	16.50

*Mine producers only.

The various basing points for finished and semi-finished steel are listed in detailed price tables, pages 134-140.
On export business there are frequent variations from the above prices. Also in domestic business, there is at times a range of prices on various products, as shown in our detailed price tables.

. . . Composite Prices

	FINISHED STEEL	PIG IRON	SCRAP STEEL
Dec. 9, 1941	2.30467c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One week ago	2.30467c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One month ago	2.30467c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One year ago	2.30467c. a Lb.	$22.61 a Gross Ton	$21.33 a Gross Ton

	FINISHED STEEL High	FINISHED STEEL Low	PIG IRON High	PIG IRON Low	SCRAP STEEL High	SCRAP STEEL Low
1941	2.30467c.,	2.30467c.,	$23.61, Mar. 20	$23.45, Jan. 2	$22.00, Jan. 7	$19.17, Apr. 10
1940	2.30467c., Jan. 2	2.24107c., Apr. 16	23.45, Dec. 23	22.61, Jan. 2	21.83, Dec. 30	16.04, Apr. 9
1939	2.35367c., Jan. 3	2.26689c., May 16	22.61, Sept. 19	20.61, Sept. 12	22.50, Oct. 3	14.08, May 16
1938	2.58414c., Jan. 4	2.27207c., Oct. 18	23.25, June 21	19.61, July 6	15.00, Nov. 22	11.00, June 7
1937	2.58414c., Mar. 9	2.32263c., Jan. 4	23.25, Mar. 9	20.25, Feb. 16	21.92, Mar. 30	12.92, Nov. 10
1936	2.32263c., Dec. 28	2.05200c., Mar. 10	19.74, Nov. 24	18.73, Aug. 11	17.75, Dec. 21	12.67, June 9
1935	2.07642c., Oct. 1	2.06492c., Jan. 8	18.84, Nov. 5	17.83, May 14	13.42, Dec. 10	10.33, Apr. 29
1934	2.15367c., Apr. 24	1.95757c., Jan. 2	17.90, May 1	16.90, Jan. 27	13.00, Mar. 13	9.50, Sept. 25
1933	1.95578c., Oct. 3	1.75836c., May 2	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan. 3
1932	1.89196c., July 5	1.83901c., Mar. 1	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.43, July 5
1931	1.99629c., Jan. 13	1.86586c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec. 29
1930	2.25488c., Jan. 7	1.97319c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1929	2.31773c., May 28	2.26498c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3

A weighted index based on steel bars, beams, tank plates, wire, rails, black pipe, hot and cold-rolled sheets and strip. These products represent 78 per cent of the United States output. This revised index recapitulated to 1929 in the Aug. 28, 1941, issue.

Based on averages for basic iron at Valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia and Chicago.

Prices of Finished Iron and Steel...

Steel prices shown here are f.o.b. basing points, in cents per lb., unless otherwise indicated. On some products either quantity deductions or quantity extras apply. In many cases gage, width, cutting, physical, chemical extras, etc., apply to the base price. Actual realized prices to the mill, therefore, are affected by extras, deductions, and in most cases freight absorbed to meet competition.

Basing Point → / Product ↓	Pittsburgh	Chicago	Gary	Cleveland	Birmingham	Buffalo	Youngstown	Sparrows Point	Granite City	Middletown, Ohio	Gulf Ports, Cars	Pacific Ports, Cars	DELIVERED TO Detroit	New York	Philadelphia
SHEETS															
Hot rolled	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.20¢	2.10¢		2.65¢	2.20¢	2.34¢	2.27¢
Cold rolled[1]	3.05¢	3.05¢	3.05¢	3.05¢		3.05¢	3.05¢		3.15¢	3.05¢		3.70¢	3.15¢	3.39¢	3.37¢
Galvanized (24 ga.)	3.50¢	3.50¢	3.50¢		3.50¢	3.50¢	3.50¢	3.50¢	3.60¢	3.50¢		4.05¢		3.74¢	3.67¢
Enameling (20 ga.)	3.35¢	3.35¢	3.35¢	3.35¢			3.35¢		3.45¢	3.35¢		4.00¢	3.45¢	3.71¢	3.67¢
Long ternes[2]	3.80¢		3.80¢									4.55¢			
STRIP															
Hot rolled[3]	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢			2.10¢		2.75¢	2.20¢	2.46¢	
Cold rolled[4]	2.80¢	2.90¢		2.80¢			2.80¢	(Worcester = 3.00¢)					2.90¢	3.16¢	
Cooperage stock	2.20¢	2.20¢			2.20¢		2.20¢							2.56¢	
Commodity C-R	2.95¢			2.95¢			2.95¢	(Worcester = 3.35¢)					3.05¢	3.31¢	
TIN PLATE															
Standard cokes, base box	$5.00	$5.00	$5.00						$5.10						$5.32
BLACK PLATE															
29 gage[5]	3.05¢	3.05¢	3.05¢						3.15¢			4.05¢ (10)			3.37¢
TERNES M'FG.															
Special coated, base box	$4.30	$4.30	$4.30						$4.40						
BARS															
Carbon steel	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢		(Duluth = 2.25¢)			2.50¢	2.80¢	2.25¢	2.49¢	2.47¢
Rail steel[6]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢					2.50¢	2.80¢			
Reinforcing (billet)[7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢			2.50¢	2.55¢	2.25¢	2.39¢	
Reinforcing (rail)[7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢				2.50¢	2.55¢	2.25¢		2.47¢
Cold finished[8]	2.65¢	2.65¢	2.65¢	2.65¢		2.65¢			(Detroit = 2.70¢)					3.01¢	2.97¢
Alloy, hot rolled	2.70¢	2.70¢				2.70¢		(Bethlehem, Massillon, Canton = 2.70¢					2.80¢		
Alloy, cold drawn	3.35¢	3.35¢	3.35¢	3.35¢		3.35¢							3.45¢		
								(Coatesville and Claymont = 2.10¢)							
PLATES															
Carbon steel	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢	2.25¢(11)		2.45¢	2.65¢	2.25¢	2.29¢	2.15¢
Wrought iron	3.80¢														
Floor plates	3.35¢	3.35¢									3.70¢	4.00¢		3.71¢	3.67¢
Alloy	3.50¢	3.50¢			(Coatesville = 3.50¢)						3.95¢	4.15¢		3.70¢	3.37¢
SHAPES															
Structural	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢		(Bethlehem = 2.10¢)			2.45¢	2.75¢		2.27¢	2.215¢
SPRING STEEL C-R															
0.26 to 0.50 Carbon	2.80¢			2.80¢			(Worcester = 3.00¢)								
0.51 to 0.75 Carbon	4.30¢			4.30¢			(Worcester = 4.50¢)								
0.76 to 1.00 Carbon	6.15¢			6.15¢			(Worcester = 6.35¢)								
1.01 to 1.25 Carbon	8.35¢			8.35¢			(Worcester = 8.55¢)								
WIRE[9]															
Bright	2.60¢	2.60¢		2.60¢	2.60¢		(Worcester = 2.70¢)					3.10¢			2.92¢
Galvanized	2.60¢	2.60¢		2.60¢	2.60¢		(Worcester = 2.70¢)					3.10¢			2.92¢
Spring	3.20¢	3.20¢		3.20¢			(Worcester = 3.30¢)					3.80¢			3.52¢
PILING															
Steel sheet	2.40¢	2.40¢				2.40¢						2.95¢			2.72¢
IRON BARS															
Common		2.25¢			(Terre Haute, Ind. = 2.15¢)										
Wrought single refined	4.40¢														
Wrought double refined	5.40¢														

[1] Mill run sheets are 10c. per 100 lb. less than base; and primes only, 25c. above base. [2] Unassorted 8-lb. coating. [3] Widths up to 12 in. [4] Carbon 0.25 per cent and less. [5] Applies to certain width and length limitations. [6] For merchant trade. [7] Straight lengths as quoted by distributers. [8] Also shafting. For quantities of 20,000 to 39,999 lb. [9] Carload lot to manufacturing trade. [10] Boxed. [11] Ship plates only.

SEMI-FINISHED STEEL

Billets, Blooms and Slabs

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point (rerolling only). Prices delivered Detroit are $2 higher; f.o.b. Duluth, billets only, $2 higher.

	Per Gross Ton
Rerolling	$34.00
Forging quality	40.00

Shell Steel

Basic open hearth shell steel, f.o.b. Pittsburgh and Chicago.

	Per Gross Ton
3 in. to 12 in.	$52.00
12 in. to 18 in.	54.00
18 in. and over	56.00

Note: The above base prices apply on lots of 1000 tons of a size and section to which are to be added extras for chemical requirements, cutting to length, or quantity.

Sheet Bars

Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point, Md.

	Per Gross Ton
Open hearth or bessemer	$34.00

Skelp

Pittsburgh, Chicago, Youngstown, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved, universal and sheared	1.90c.

Wire Rods

(No. 5 to 9/32 in.)	*Per Lb.*
Pittsburgh, Chicago, Cleveland.	2.00c.
Worcester, Mass.	2.10c.
Birmingham	2.00c.
San Francisco	2.50c.
Galveston	2.25c.

9/32 in. to 47/64 in., 0.15c. a lb. higher. Quantity extras apply.

Alloy Steel Blooms, Billets and Slabs

	Per Gross Ton
Pittsburgh, Chicago, Canton, Massillon, Buffalo or Bethlehem	$54.00

TOOL STEEL

(F.o.b. Pittsburgh)

	Base per Lb.
High speed	67c.
High-carbon-chromium	43c.
Oil hardening	24c.
Special carbon	22c.
Extra carbon	18c.
Regular carbon	14c.

Prices for warehouse distribution to all points on or East of Mississippi River are 2c. a lb. higher. West of Mississippi quotations are 3c. a lb. higher.

PIG IRON

All prices set in bold face type are maxima established by OPA on June 24, 1941. Other domestic prices are delivered quotations per gross ton computed on the basis of the official maxima.

	No. 2 Foundry	Basic	Bessemer	Malleable	Low Phosphorous	Charcoal
Boston	$25.50	$25.00	$26.50	$26.00	.....	.....
Brooklyn	27.50	.....	.....	28.00	.....	.....
Jersey City	26.53	26.03	27.53	27.03	.....	.....
Philadelphia	25.84	25.34	26.84	26.34	.....	.....
Bethlehem, Pa.	**$25.00**	**$24.50**	**$26.00**	**$25.50**	.....	.....
Everett, Mass.	**25.00**	**24.50**	**26.00**	**25.50**	.....	.....
Swedeland, Pa.	**25.00**	**24.50**	**26.00**	**25.50**	.....	.....
Steelton, Pa.	.....	**24.50**	.....	.....	**$29.50**	.....
Birdsboro, Pa.	**25.00**	**24.50**	**26.00**	**25.50**	**29.50**	.....
Sparrows Point, Md.	**25.00**	**24.50**	.....	.....	.....	.....
Erie, Pa.	**24.00**	**23.50**	**25.00**	**24.50**	.....	.....
Neville Island, Pa.	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Sharpsville, Pa.*	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Buffalo	**24.00**	**23.00**	**25.00**	**24.50**	**29.50**	.....
Cincinnati	24.44	24.61	.....	25.11	.....	.....
Canton, Ohio	25.39	24.89	25.89	25.39	.....	.....
Mansfield, Ohio	25.94	25.44	26.44	25.94	.....	.....
St. Louis	24.50	24.02	.....	.....	.....	.....
Chicago	**24.00**	**23.50**	**24.50**	**24.00**	.....	....$31.34
Granite City, Ill.	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Cleveland	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Hamilton, Ohio	**24.00**	**23.50**	.....	**24.00**	.....	.....
Toledo	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Youngstown*	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Detroit	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Lake Superior fc.	.....	.....	.....	.....	.....	**$28.00**
Lyles, Tenn. fc.†	.....	.....	.....	.....	.....	**33.00**
St. Paul	26.63	.....	27.13	26.63	.....	.....
Duluth	**24.50**	.....	**25.00**	**24.50**	.....	.....
Birmingham	**20.38**	**19.00**	**25.00**	.....	.....	.....
Los Angeles	27.50	.....	.....	.....	.....	.....
San Francisco	27.50	.....	.....	.....	.....	.....
Seattle	27.50	.....	.....	.....	.....	.....
Provo, Utah	**22.00**	.....	.....	.....	.....	.....
Montreal	27.50	27.50	.....	28.00	.....	.....
Toronto	25.50	25.50	.....	26.00	.....	.....

GRAY FORGE IRON

Valley or Pittsburgh furnace **$23.50**

*Pittsburgh Coke & Iron Co. (Sharpsville, Pa., furnace only) and the Struthers Iron and Steel Co., Struthers, Ohio, may charge 50c. a ton in excess of basing point prices for No. 2 foundry, basic, bessemer and malleable.

Switching Charges: Basing point prices are subject to an additional charge for delivery within the switching limits of the respective districts.

Silicon Differentials: Basing point prices are subject to an additional charge not to exceed 50c. a ton for each 0.25 per cent silicon content in excess of basic grade (1.75 per cent to 2.25 per cent).

Phosphorous Differential: Basing point prices are subject to a reduction of 38c. per ton for phosphorous content of 0.70 per cent and over.

†Price shown is for low-phosphorous iron; high-phosphorous sells for $28.50 at the furnace.

Manganese Differentials: Basing point prices are subject to an additional charge not to exceed 50c. a ton for each 0.50 per cent manganese content in excess of 1.00 per cent.

WAREHOUSE PRICES

	Pittsburgh	Chicago	Cleveland	Philadelphia	New York	Detroit	Buffalo	Boston	Birmingham	St. Louis	St. Paul	Milwaukee	Los Angeles
Sheets, hot rolled	$3.35	$3.25	$3.35	$3.75	$3.58	$3.43	$3.25	$3.71	$3.45	$3.39	$3.30	$3.38	$5.10
Sheets, cold rolled	....	4.10	4.05	4.05	4.60	4.30	4.30	3.68	....	4.24	4.35	4.23	7.30
Sheets, galvanized	4.65	4.85	4.75	5.00	5.00	4.84	4.75	5.11	4.75	4.99	4.75	4.98	6.30
Strip, hot rolled	3.60	3.60	3.50	3.95	3.96	3.68	3.82	4.06	3.70	3.74	3.65	3.73	....
Strip, cold rolled	3.20	3.50	3.20	3.31	3.51	3.40	3.52	3.46	....	3.61	3.83	3.54	....
Plates	3.40	3.55	3.40	3.75	3.76	3.60	3.62	3.85	3.55	3.69	3.80	3.68	4.95
Structural shapes	3.40	3.55	3.58	3.75	3.75	3.65	3.40	3.85	3.55	3.69	3.80	3.68	4.95
Bars, hot rolled	3.35	3.50	3.25	3.85	3.84	3.43	3.35	3.98	3.50	3.64	3.75	3.63	**4.15
Bars, cold finished	3.65	3.75	3.75	4.06	4.09	3.80	3.75	4.13	4.43	4.02	4.34	3.88	6.60
Bars, ht. rld. SAE 2300	7.45	7.35	7.55	7.31	7.60	7.67	7.35	7.50	....	7.72	7.45	7.58	10.35
Bars, ht. rld. SAE 3100	5.75	5.65	5.85	5.86	5.90	5.97	5.65	6.05	....	6.02	6.00	5.88	9.35
Bars, cd. drn. SAE 2300	8.40	8.40	8.40	8.56	8.84	8.70	8.40	8.63	....	8.77	8.84	8.63	11.35
Bars, cd. drn. SAE 3100	6.75	6.75	7.75	7.16	7.19	7.05	6.75	7.23	....	7.12	7.44	6.98	10.35

BASE QUANTITIES: Hot rolled sheets, cold rolled sheets, hot rolled strip, plates, shapes and hot rolled bars, 400 to 1999 lb., galvanized sheets, 150 to 1499 lb.; cold rolled strip, extras apply on all quantities; cold finished bars, 1500 lb. and over; SAE bars, 1000 lb. and over. Exceptions: Chicago, galvanized sheets, 500 to 1499 lb.; Philadelphia, galvanized sheets, one to nine bundles, cold rolled sheets, 1000 to 1999 lb.; Detroit, galvanized sheets, 500 to 1499 lb.; Buffalo, cold rolled sheets, 500 to 1500 lb., galvanized sheets, 450 to 1499 lb., cold rolled strips, 0.0971 in. thick; Boston, cold rolled and galvanized sheets, 450 to 3749 lb.; Birmingham, hot rolled sheets, strip and bars, plates and shapes, 400 to 3999 lb., galvanized sheets, 500 to 1499 lb.; St. Louis, cold rolled sheets, 400 to 1499 lb., galvanized sheets, 500 to 1499 lb., cold rolled strip 0.095 in. and lighter; Milwaukee, cold rolled sheets, 400 to 1499 lb., galvanized sheets, 500 to 1499 lb., New York, hot rolled sheets, 0 to 1999 lb., cold rolled sheets, 400 to 1499 lb.; St. Paul, galvanized and cold rolled sheets, any quantity, hot rolled bars, plates, shapes, hot rolled sheets, 400 to 14,999 lb.; Los Angeles, cold rolled sheets, 300 to 1999 lb., galvanized sheets, 24 ga.—1 to 1499 lb. Extras for size, quality, etc., apply on above quotations. *12 gage and heavier, $3.43. **Over 4 in. wide and over 1 in. thick, $4.95.

CORROSION AND HEAT-RESISTING STEELS

(Per lb. base price, f.o.b. Pittsburgh)

Chromium-Nickel Alloys

	No. 304	No. 302
Forging billets	21.25c.	20.40c.
Bars	25.00c.	24.00c.
Plates	29.00c.	27.00c.
Structural shapes	25.00c.	24.00c.
Sheets	36.00c.	34.00c.
Hot rolled strip	23.50c.	21.50c.
Cold rolled strip	30.00c.	28.00c.
Drawn wire	25.00c.	24.00c.

Straight-Chromium Alloys

	No. 410	No. 430	No. 442	No. 446
F.Billets	15.73c.	16.15c.	19.13c.	23.38c.
Bars	18.50c.	19.00c.	22.50c.	27.50c.
Plates	21.50c.	22.00c.	25.50c.	30.50c.
Sheets	26.50c.	29.00c.	32.50c.	36.50c.
Hotstrip	17.00c.	17.50c.	24.00c.	25.00c.
Cold st.	22.00c.	22.50c.	32.00c.	52.00c.

Chromium-Nickel Clad Steel (20%)

	No. 304
Plates	18.00c.*
Sheets	19.00c.

*Includes annealing and pickling.

ELECTRICAL SHEETS

(Base, f.o.b. Pittsburgh)

	Per Lb.
Field grade	3.20c.
Armature	3.55c.
Electrical	4.05c.
*Motor	4.95c.
*Dynamo	5.65c.
Transformer 72	6.15c.
Transformer 65	7.15c.
Transformer 58	7.65c.
Transformer 52	8.45c.

Silicon strip in coils—Sheet price plus silicon sheet extra width extra plus 25c. per 100 lb. for coils. Pacific ports add 75c. per 100 lb.

*In some instances motor grade is referred to as dynamo grade and dynamo grade is referred to as dynamo special.

ROOFING TERNE PLATE

(F.o.b. Pittsburgh, per Package of 112 Sheets)

	20x14 in.	20x28 in.
8-lb. coating I.C.	$6.00	$12.00
15-lb. coating I.C.	7.00	14.00
20-lb. coating I.C.	7.50	15.00
25-lb. coating I.C.	8.00	16.00
30-lb. coating I.C.	8.63	17.25
40-lb. coating I.C.	9.75	19.50

BOLTS, NUTS, RIVETS, SET SCREWS

Bolts and Nuts

F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

Per Cent Off List

Machine and Carriage Bolts:

6½ in., shorter and smaller	65½
6 x ⅝ in., and shorter	63½
6 in. by ¾ to 1 in. and shorter	61
1⅛ in. and larger, all length	59
All diameters over 6 in. long	59
Lag, all sizes	62
Plow bolts	65

Nuts, Cold Punched or Hot Pressed:

(hexagon or square)

½ in. and smaller	62
9/16 to 1 in. inclusive	59
1⅛ to 1½ in. inclusive	57
1⅝ in. and larger	56

On above bolts and nuts, excepting plow bolts, additional allowance of 10 per cent for full container quantities. There is an additional 5 per cent allowance for carload shipments.

Semi-Fin. Hexagon Nuts	U.S.S.	S.A.E.
7/16 in. and smaller	..	64
½ in. and smaller	62	..
½ in. through 1 in.	..	60
9/16 to 1 in.	59	..
1⅛ in. through 1½ in.	57	58
1⅝ in. and larger	56	..

In full container lots, 10 per cent additional discount.

Stove bolts, packages, nuts loose 71 and 10

Stove bolts in packages, with nuts attached 71

Stove bolts in bulk.....80

On stove bolts freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago, New York lots of 200 lb. or over.

Large Rivets

(½ in. and larger)

Base per 100 lb.

F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham $3.75

Small Rivets

(7/16 in. and smaller)

Per Cent Off List

F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham .....65 and 5

Cap and Set Screws

Per Cent Off List

Upset hex. head cap screws U.S.S. or S.A.E. thread, 1 in. and smaller	60
Upset set screws, cup and oval points	68
Milled studs	40
Flat head cap screws, listed sizes	30
Filister head cap, listed sizes	46

Freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago or New York on lots of 200 lb. or over.

WIRE PRODUCTS

(To the trade, f.o.b. Pittsburgh, Chicago, Cleveland, Birmingham)

Base per Keg

Standard wire nails.....$2.55

Coated nails 2.55

Cut nails, carloads..... 3.85

Base per 100 Lb.

Annealed fence wire.....$3.05

Base Column

Woven wire fence*	67
Fence posts (carloads)	69
Single loop bale ties	59
Galvanized barbed wire†	70
Twisted barbless wire	70

*15½ gage and heavier. †On 80-rod spools in carload quantities.

Note: Birmingham base same on above items, except spring wire.

BOILER TUBES

Seamless Steel and Lap Weld Commercial Boiler Tubes and Locomotive Tubes Minimum Wall

(Net base prices per 100 ft., f.o.b. Pittsburgh, in carload lots)

	Seamless Cold Drawn	Hot Rolled	Lap Weld, Hot Rolled
	$	$	$
2 in. o.d. 13 B.W.G.	15.03	13.04	12.38
2½ in. o.d. 12 B.W.G.	20.21	17.54	16.58
3 in. o.d. 12 B.W.G.	22.48	19.50	18.35
3½ in. o.d. 11 B.W.G.	28.37	24.62	23.15
4 in. o.d. 10 B.W.G.	35.20	30.54	28.66

(Extras for less carload quantities)

40,000 lb. or ft. over	Base
30,000 lb. or ft. to 39.999 lb. or ft.	5%
20,000 lb. or ft. to 29.999 lb. or ft.	10%
10,000 lb. or ft. to 19,999 lb. or ft.	20%
5,000 lb. or ft. to 9,999 lb. or ft.	30%
2,000 lb. or ft. to 4,999 lb. or ft.	45%
Under 2,000 lb. or ft.	65%

STEEL AND WROUGHT IRON PIPE AND TUBING

Welded Pipe

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio, Mills

(F.o.b. Pittsburgh only on wrought pipe)

Base Price = $200 Per Net Ton

Steel (Butt Weld)

	Black	Galv.
½ in.	63½	51
¾ in.	66½	55
1 to 3 in.	68½	57½

Wrought Iron (Butt Weld)

½ in.	24	3½
¾ in.	30	10
1 and 1¼ in.	34	16
1½ in.	38	18½
2 in.	37½	18

Steel (Lap Weld)

2 in.	61	49½
2½ and 3 in.	64	52½
3½ to 6 in.	66	54½

Wrought Iron (Lap Weld)

2 in.	30½	12
2½ to 3½ in.	31½	14½
4 in.	33½	18
4½ to 8 in.	32½	17

Steel (Butt, extra strong, plain ends)

	Black	Galv.
½ in.	61½	50½
¾ in.	65½	54½
1 to 3 in.	67	57

Wrought Iron (Same as Above)

½ in.	25	6
¾ in.	31	12
1 to 2 in.	38	19½

Steel (Lap, extra strong, plain ends)

2 in.	59	48½
2½ and 3 in.	63	52½
3½ to 6 in.	66½	56

Wrought Iron (Same as above)

2 in.	33½	15½
2½ to 4 in.	39	22½
4½ to 6 in.	37½	21

On butt weld and lap weld steel pipe jobbers are granted a discount of 5%. On less-than-carload shipments prices are determined by adding 25 and 30% and the carload freight rate to the base card.

F.o.b. Gary prices are two points lower discount or $4 a ton higher than Pittsburgh or Lorain on lap weld and one point lower discount, or $2 a ton higher on all butt weld 8 in. and smaller.

CAST IRON WATER PIPE

Per Net Ton

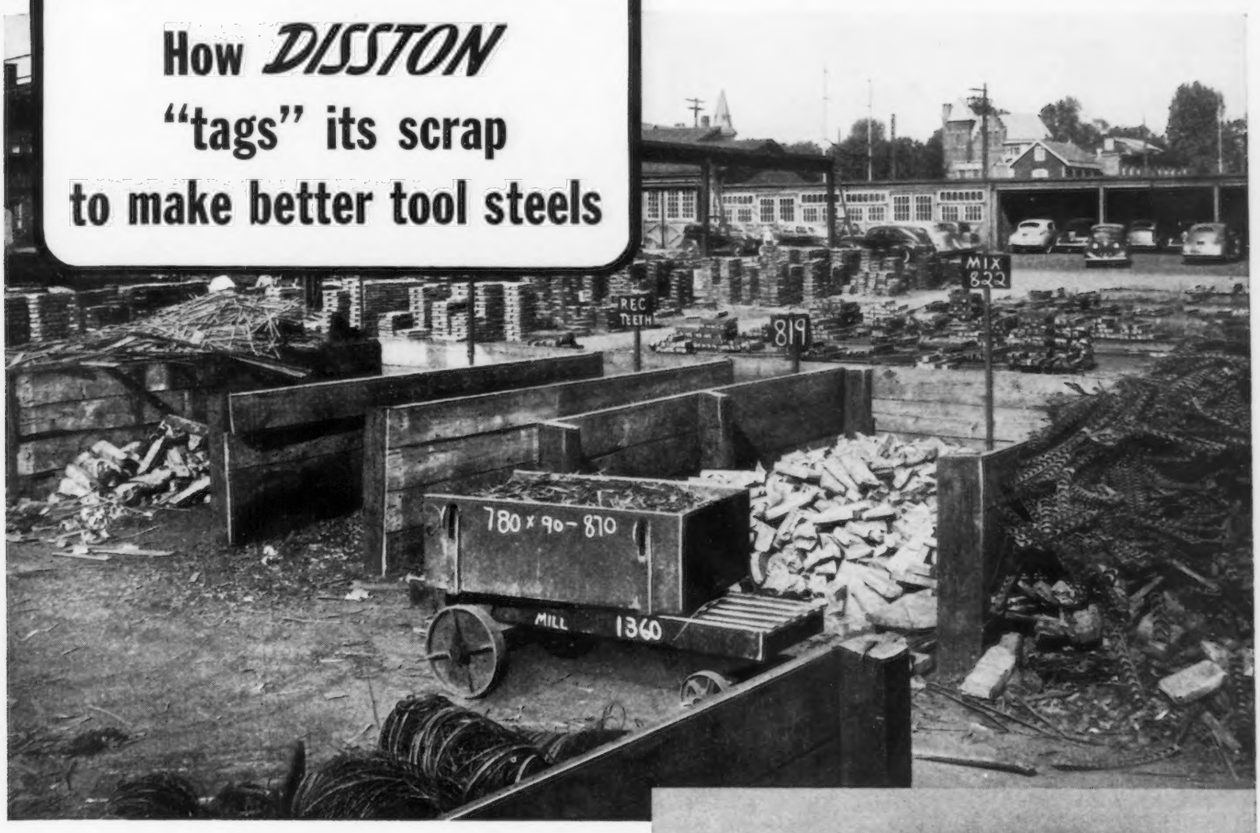
6-in. and larger, del'd Chicago	$54.80
6-in. and larger, del'd New York	52.20
6-in. and larger, Birmingham	46.00
6-in. and larger f.o.b. dock, San Francisco or Los Angeles or Seattle	56.00

Class "A" and gas pipe, $3 extra; 4-in. pipe is $3 a ton above 6-in. Prices shown are for lots of less than 200 tons. For 200 tons or over, 6-in. and larger is $45 at Birmingham and $53.80 delivered Chicago.

FUEL OIL

No. 3, f.o.b. Bayonne, N. J.	5.20c.
No. 6. f.o.b. Bayonne, N. J.	3.21c.
No. 6 Bur. Stds., del'd Chicago	4.50c.
No. 3 distillate del'd Cleveland	6.50c.
No. 4 indus., del'd Cleveland	6.00c.
No. 6 indus., del'd Cleveland	5.00c.

How *DISSTON* "tags" its scrap to make better tool steels



If you were to visit the scrap yard of the Disston Steel Works, you'd see various analyses of steel scrap waiting to go into Disston's electric furnaces.

You'd notice how piles of scrap are separated from each other in carefully labeled bins . . . And you'd probably understand that Disston segregates and "tags" its scrap so that each electric melting charge will contain exactly the right raw materials.

This care in the scrap yard is typical of the thoroughness that produces today's improved Disston Tool Steels. Alloys of seven or eight elements are added and controlled within close limits by Disston metallurgists . . . grain size is pre-determined . . . greater soundness and cleanliness are achieved.

Thus Disston has been able to produce such superior tool steels as D-9-Va . . . an extremely tough cutting steel, highly resistant to edge spalling, which changes very slightly in size during heat treatment.

Free service to tool makers: Disston metallurgists and tool engineers will be glad to help you in selecting the best tool steels for each job in your plant . . . to assure you of more "mileage" per tool. Also, you'll find valuable practical information in the illustrated 73-page catalog, "Disston Tool Steels." If you haven't received your free copy, write today to Henry Disston & Sons, Inc., 1219 Tacony, Philadelphia, Pa.

D-9-Va proves its toughness in cutting metals

A manganese-vanadium alloy steel, D-9-Va was originally developed for tap makers who wanted an oil hardening steel with great toughness and very slight change in size in heat treatment. D-9-Va has since *proved excellent* for many metal cutting applications, such as for turning cast iron rolls. For this type of work, it may be water quenched to very high Rockwells and will maintain a fair degree of toughness. Use D-9-Va wherever you need a cutting tool of medium cross section, or one requiring extremely high Rockwell hardness, which must also be exceptionally tough and resistant to edge spalling.

ESTABLISHED 1840
REG. U.S. PAT. OFF.

HENRY DISSTON & SONS, INC.
1219 Tacony, Philadelphia, Pa.
I don't have a copy of your catalog, "Disston Tool Steels."
Please send me one, without obligation, today.

*Name*_____

*Company*_____

*Address*_____

DISSTON TOOL STEELS

FERROALLOYS

Ferromanganese

F.o.b. New York, Philadelphia, Baltimore, Mobile or New Orleans, Domestic, 80%, per gross ton (carloads).....$120.00

Spiegeleisen

Per Gross Ton Furnace

Domestic, 19 to 21%.....$36.00
Domestic, 26 to 28%..... 49.50

Electric Ferrosilicon

(Per Gross Ton, Delivered Lump Size)

50% (carload lots, bulk).....$74.50
50% (ton lots, packed..... 87.00
75% (carload lots, bulk).....135.00
75% (ton lots, packed).....151.00

Silvery Iron

(Per Gross Ton, base 6.00 to 6.50 Si)

F.O.B. Jackson, Ohio.....$29.50*
Buffalo $30.75*

For each additional 0.50% silicon add $1 a ton. For each 0.50% manganese over 1% add 50c. a ton. Add $1 a ton for 0.75% phosphorus or over.

*Official OPACS price established June 24.

Bessemer Ferrosilicon

Prices are $1 a ton above Silvery Iron quotations of comparable analysis.

Ferrochrome

(Per Lb. Contained Cr, Delivered Carlots, Lump Size, on Contract)

4 to 6 carbon.....13.00c.
2 carbon .....19.50c.
1 carbon .....20.50c.
0.10 carbon .....22.50c.
0.06 carbon .....23.00c.

Spot prices are ¼c. per lb. of contained chromium higher.

Silico-Manganese

(Per Gross Ton, Delivered, Lump Size, Bulk, on Contract)

3 carbon $113.00*
2.50 carbon 118.00*
2 carbon 123.00*
1 carbon 133.00*

Other Ferroalloys

Ferrotungsten, per lb. contained W, del'd carload.... $2.00
Ferrotungsten, 100 lb. and less $2.25
Ferrovanadium, contract, per lb. contained V, del'd $2.70 to $2.90†
Ferrocolumbium, per lb. contained Cb, f.o.b. Niagara Falls, N. Y., ton lots..... $2.25†
Ferrocarbontitanium, 15-18 Ti, 7-8 C, f.o.b. furnace, carload, contract, net ton.....$142.50
Ferrocarbontitanium, 17-20 Ti, 3-5 C, f.o.b. furnace, carload, contract, net ton.....$157.50
Ferrophosphorus, electric or blast furnace material, carloads, f.o.b. Anniston, Ala., for 18%, with $3 unitage freight, equalized with Rockdale, Tenn., gross ton..... $58.50
Ferrophosphorus, electrolytic 23-26%, carlots, f.o.b. Monsanto (Siglo), Tenn., $3 unitage, freight equalized with Nashville, gross ton..... $75.00
Ferromolybdenum, per lb. Mo, f.o.b. furnace ..... 95c.
Calcium molybdate, per lb. Mo, f.o.b. furnace..... 80c.
Molybdenum oxide briquettes 48-52 Mo, per lb. contained Mo, f.o.b. Langeloth, Pa.... 80c.
Molybdenum oxide, in cans, per lb. contained Mo, f.o.b. Langeloth, and Washington, Pa. 80c.

*Spot prices are $5 per ton higher. †Spot prices are 10c. per lb. of contained element higher.

ORES

Lake Superior Ores (51.50% Fe.)

(Delivered Lower Lake Ports)

Per Gross Ton

Old range, bessemer, 51.50.... $4.75
Old range, non-bessemer, 51.50 4.60
Mesaba, bessemer, 51.50..... 4.60
Mesaba, non-bessemer, 51.50... 4.45
High phosphorus, 51.50..... 4.35

Foreign Ores*

(C.i.f. Philadelphia or Baltimore, Exclusive of Duty)

Per Unit

African, Indian, 44-48 Mn..65c. to 66c.
African, Indian, 49-51 Mn..67c. to 69c.
Brazilian, 46-48 Mn.....69c.
Cuban, 51 Mn .....78c.

Per Short Ton Unit

Tungsten, Chinese Wolframite, duty paid, delivered.....$24 to $26
Tungsten, domestic scheelite, at mine .....$24.00 to $25.00
Chrome ore, lump, c.i.f. Atlantic Seaboard, per gross ton; South African (low grade)..Nom.
Rhodesian, 45 .....$32.00
Rhodesian, 48 .....$39.00-$40.00

*Importations no longer readily available. Prices shown are nominal.

COKE*

Furnace

Per Net Ton

Connellsville, prompt ...$6.00 to $6.25

Foundry

Connellsville, prompt ...$6.75 to $7.00

*Maximum coke prices established by OPA became effective Oct. 1, 1941. A complete schedule of the ceiling prices was published in THE IRON AGE, Sept. 25, p. 94B. †F.O.B. oven.

By-product, Chicago $12.25
By-product, New England.....$13.75
By-product, Newark..$12.40 to $12.95
By-product, Philadelphia $12.38
By-product, Cleveland $12.30
By-product, Cincinnati $11.75
By-product, Birmingham .....$8.50†
By-product, St. Louis.....$12.02
By-product, Buffalo $12.50

RAILS, TRACK SUPPLIES

(F.o.b. Mill)

Standard rails, heavier than 60 lb., gross ton.....$40.00
Angle bars, 100 lb..... 2.70

(F.o.b. Basing Points) *Per Gross Ton*

Light rails (from billets).....$40.00
Light rails (from rail steel)... 39.00

Base per Lb.

Cut spikes ..... 3.00c.
Screw spikes ..... 5.15c.
Tie plates, steel..... 2.15c.
Tie plates, Pacific Coast..... 2.30c.
Track bolts, heat treated, to railroads ..... 5.00c.
Track bolts, jobbers discount.. 63-5

Basing points, light rails—Pittsburgh, Chicago, Birmingham; spikes and tie plates—Pittsburgh, Chicago, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minneaqua, Colo., Birmingham and Pacific Coast ports; tie plates alone—Steelton, Pa., Buffalo; spikes alone—Youngstown, Lebanon, Pa., Richmond, Va.

FLUORSPAR

Per Net Ton

Domestic washed gravel, 85-5 f.o.b. Kentucky and Illinois mines, all rail.....$22.00 to $23.00
Domestic, f.o.b. Ohio River landing barges .....22.00 to 23.00
No. 2 lump, 85-5 f.o.b. Kentucky and Illinois mines...22.00 to 23.00
Foreign, 85% calcium fluoride, not over 5% Si, c.i.f. Atlantic ports, duty paid.....Nominal
Domestic No. 1 ground bulk, 96 to 98%, calcium fluoride, not over 2½% silicon, f.o.b. Illinois and Kentucky mines.... 31.00
As above, in bags, f.o.b. same mines 32.60

REFRACTORIES

(F.o.b. Works)

Fire Clay Brick *Per 1000*

Super-duty brick, St. Louis...$64.60
First quality, Pennsylvania, Maryland, Kentucky, Missouri and Illinois 51.30
First quality, New Jersey..... 56.00
Second quality, Pennsylvania, Maryland, Kentucky, Missouri and Illinois 46.55
Second quality, New Jersey.... 51.00
No. 1, Ohio..... 43.00
Ground fire clay, net ton..... 7.60

Silica Brick

Pennsylvania $51.30
Chicago District 58.90
Birmingham 51.30
Silica cement, net ton (Eastern) 9.00

Chrome Brick *Per Net Ton*

Standard, f.o.b. Baltimore, Plymouth Meeting and Chester...$54.00
Chemically bonded, f.o.b. Baltimore, Plymouth Meeting and Chester, Pa. 54.00

Magnesite Brick

Standard f.o.b. Baltimore and Chester $76.00
Chemically bonded, f.o.b. Baltimore 65.00

Grain Magnesite

Domestic, f.o.b. Baltimore and Chester in sacks.....$44.00
Domestic, f.o.b. Chewelah, Wash. (in bulk) 22.00

SALES POSSIBILITIES

. . . CONSTRUCTION, PLANT EXPANSION AND EQUIPMENT BUYING

North Atlantic States

• **American Steel & Wire Co.,** Worcester, Mass., has let general contract to M. J. Dyer & Co., 58 Front Street, for one-story addition at South Works for expansion in machine shop. Cost about $50,000 with equipment.

John Bath & Co., Inc., Worcester, Mass., taps, micrometers and kindred precision equipment, plans expansion for production of ordnance equipment for government, fund of $405,000 to be furnished by Defense Plant Corp., Washington, for equipment.

Peerless Aluminum Castings Co., Andover and Albion Streets, Bridgeport, Conn., aluminum, brass, bronze and other metal castings, will take bids on revised plans for one-story addition, 65 x 140 ft. Cost over $50,000 with equipment. Peter P. Petrofsky, 955 Main Street, is architect.

Bird & Son, Inc., East Walpole, Mass., roofing and building papers, wallboard, etc., has let general contract to Vappi & Co., Inc., 240 Sidney Street, Cambridge, Mass., for one-story addition, 155 x 360 ft., to branch plant at Phillipsdale, R. I., for expansion in dryer department and other divisions. Cost over $100,000 with equipment. Ganteaume & McMullen, 99 Chauncy Street, Boston, are consulting engineers.

General Ship & Engine Works, Inc., 336 Border Street, East Boston, Mass., marine equipment, ship construction, etc., plans expansion in facilities for naval vessels for government, which will provide fund of $210,000 through Defense Plant Corp., Washington.

Dictaphone Corp., 375 Howard Avenue, Bridgeport, Conn., dictating machines and parts, has let general contract to Tomlinson & Hawley, 472 North Avenue, for one-story addition, 60 x 200 ft., for storage and distribution. Cost close to $60,000 with equipment.

Public Works Officer, Navy Yard, Portsmouth, N. H., asks bids (no closing date stated) for one-story addition to oil storage and distributing building (Specification 10695).

Hanson-Whitney Machine Co., Bartholomew Avenue, Hartford, Conn., metal-shaping machinery and parts, has arranged for fund of about $263,775 through Defense Plant Corp., Washington, for equipment installation for production of ordnance specialties for government.

Jiffy Join, Inc., 36 West Twenty-fifth Street, New York, specialty metal fasteners, etc., has leased one-story building, 160 x 165 ft., to be erected at Marysville, Ohio, by a local realty organization, for new plant. Cost over $65,000 with equipment.

Jacob Ruppert Brewing Co., 1639 Third Avenue, New York, and 85 Commerce Street, New Haven, Conn., has let general contract to Frank P. Sullivan, Inc., 110 Tyler Street, East Haven, Conn., for new one-story factory branch, storage and distributing plant, 60 x 115 ft., at Hamden, Conn. Cost over $50,000 with equipment. Ely Jacques Kahn, 2 Park Avenue, New York, is architect; Norton & Townsend, 405 Temple Street, New Haven, are associate architects.

Otis Elevator Co., 260 Eleventh Avenue, New York, plans to convert part of local plant for production of nautical equipment for government, and will install equipment to cost about $147,587. Fund in that amount will be furnished by Defense Plant Corp., Washington.

Board of Education, 110 Livingston Street, Brooklyn, has let contract to Depot Construction Corp., 450 Seventh Avenue, New York, for excavation and piling for new multi-story Wilbur Wright high school for aviation trades at La Guardia Field, New York Municipal Airport, Queens. Cost about $2,600,000 with equipment.

General Electric Co., Schenectady, N. Y., plans expansion in branch plants at Fort Wayne, Ind., and Philadelphia, for production of aircraft parts for government. Equipment installations will cost about $774,700, fund in that amount to be furnished by Defense Plant Corp., Washington.

Farrel-Birmingham Co., Inc., 344 Vulcan Street, Buffalo, gear-generating machines, gears, flexible couplings, etc., has let general contract to H. F. Stimm, Inc., Ellicott Square, for one-story addition, 50 x 200 ft. Cost over $65,000 with equipment.

Haloid Co., 6 Haloid Street, Rochester, N. Y., processed photographic papers, films, etc., has let general contract to John Luther & Sons Co., 87 Stillson Street, for one-story addition, 40 x 250 ft. Cost over $60,000 with equipment.

I. Jacoel, 1880 Hertel Avenue, Buffalo, cable splicing equipment and parts, plans expansion with installation of equipment to triple present working force.

Westinghouse Electric & Mfg. Co., Lamp Division, Bloomfield, N. J., electric lamps, radio tubes, etc., has leased one-story building at 20 Main Street, Orange, N. J., totaling about 30,000 sq. ft. of floor space, for new factory branch, storage and distributing plant.

General Ceramics Co., Crows Mill Road, Keasbey, N. J., chemical stoneware, sanitary ware, etc., plans expansion for production of special electrical insulators for government, to cost about $132,875 with equipment. Fund in that amount will be furnished by Defense Plant Corp., Washington.

Commanding Officer, Ordnance Department, Picatinny Arsenal, near Dover, N. J., asks bids until Dec. 15 for high-speed steel twist drills (Circular 1172), reamers (Circular 1185), cable (Circular 1187).

American Platinum Works, Inc., 231 New Jersey Railroad Avenue, Newark, N. J., platinum, gold, silver, etc., plans one-story addition. Cost over $50,000 with equipment. Epple & Kahrs, 15 Washington Street, are architects and engineers.

Port Newark Shipbuilding Corp., Port Newark, Newark, N. J., recently organized by Thomas V. Standifer and associates, has leased former shipyard on Newark Bay, Port Newark, now held by city, and will modernize for production of concrete cargo barges for government, for which initial order for five, costing about $3,000,000, has been secured. Two shipways will be reconditioned, with shop structures and equipment installation.

State Purchase Commission, State House, West State Street, Trenton, N. J., asks bids until Dec. 22 for ventilating units, steel file cabinets, and other equipment.

Midvale Co., Nicetown, Philadelphia, has let contract to Carter Paving Co., Fiftieth Street and Lancaster Avenue, for foundations for one-story press shop. Cost over $100,000 with equipment.

Wayne Tool Mfg. Co., Waynesboro, Pa., countersinks, drill chucks, reamers, etc., plans installation of additional equipment for production of ordnance specialties for government. Cost about $60,000, fund to be secured through Defense Plant Corp., Washington.

Proctor & Schwartz, Inc., Seventh Street and Tabor Road, Philadelphia, mechanical-drying machinery, textile mill equipment, etc., has leased one-story building at Tenth Street and Windrim Avenue for expansion.

Monessen Coke & Chemical Co., Monessen, Pa., by-product coke specialties, industrial chemicals, etc., has approved plans for one-story addition for expansion in chemical division. Cost close to $60,000 with equipment.

Blaw-Knox Co., Union Steel Casting Division, Sixty-second and Butler Streets, Pittsburgh, plans new one-story plant near present works for production of military tank equipment for government. Cost about $1,740,000, fund in that amount to be secured through Defense Plant Corp., Washington, for site, buildings and machinery.

United States Engineer Office, Post Office Building, Baltimore, asks bids until Dec. 29 for two pumping stations and appurtenant works at Plymouth, Pa.

Maryland Dry Dock Co., Fairfield, Baltimore, has asked bids on general contract for one-story machine shop. Cost over $120,000 with equipment. This is part of expansion and improvements being carried out for construction and repair of vessels for government, which has authorized fund of $5,000,000 for project. General contract has been let to Lacchi Construction Co., 337 St. Paul Place, for one-story pipe and electric shops. Cost close to $100,000 with equipment. J. E. Greiner Co., 1201 St. Paul Street, is consulting engineer.

E. I. du Pont de Nemours & Co., Inc., Rayon Department, du Pont Building, Wilmington, Del., plans new processing and production units in nylon mill at Seaford, Del., with installation of equipment to advance output about 50 per cent. Also will carry out extensions in branch mill at Belle, W. Va., for production of nylon intermediates for Seaford plant. Entire project will cost over $2,000,000 with equipment.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Dec. 16 for steel barrels (Schedule 9534), steel anchors (Schedule 9554) for Eastern and Western yards.

The South

• **Dooley's Basin & Dry Dock, Inc.,** 1500 S. W. Twentieth Street, Fort Lauderdale, Fla., plans extensions and improvements in shipways, shops and other facilities, including equipment. Cost about $100,000. Financing in that amount has been arranged through Federal aid.

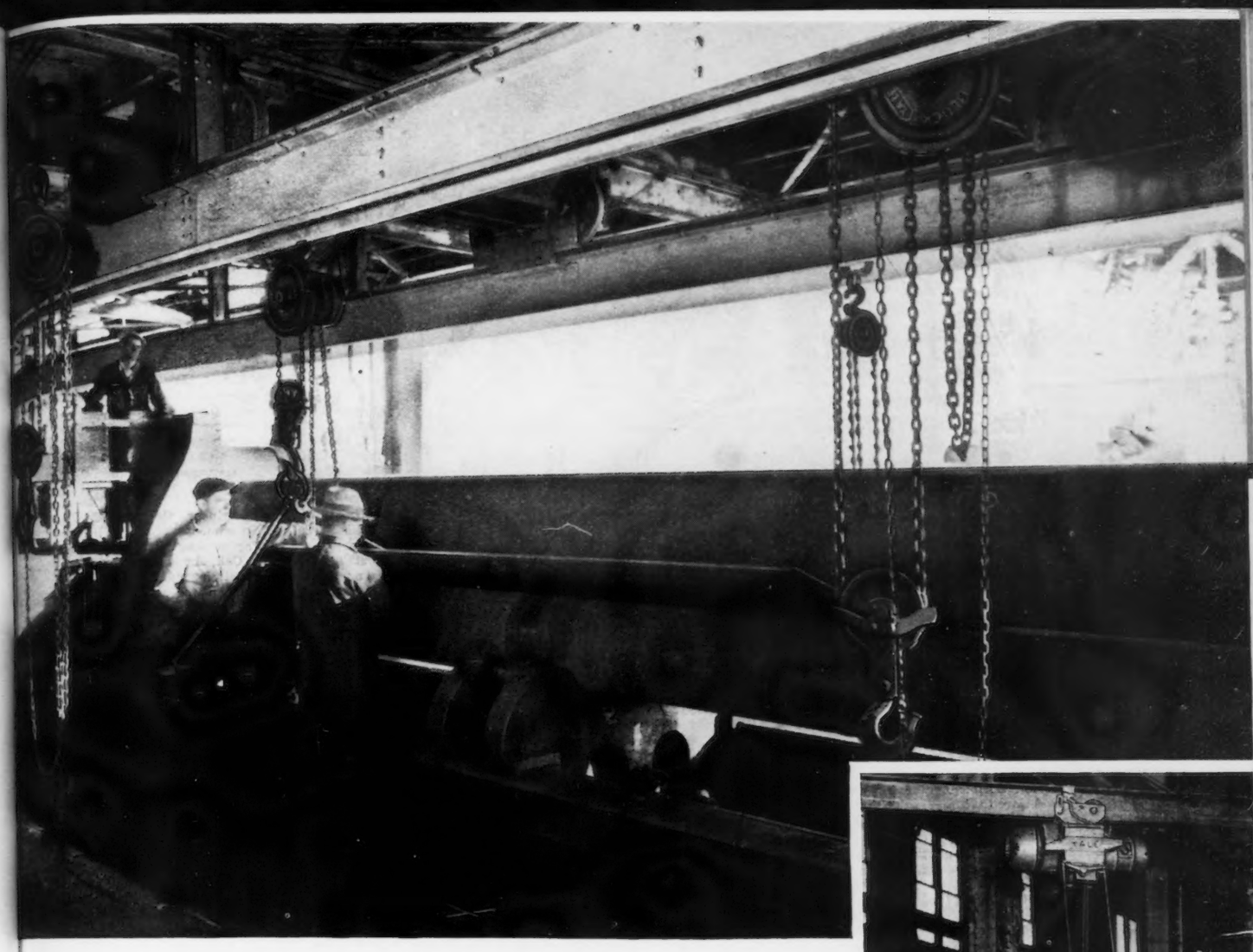
War Department, Twentieth Street and Constitution Avenue, S. W., Washington, has let contract to Chemical Construction Corp., 30 Rockefeller Plaza, New York, for design and supervision of erection for new plant at Myrtle Grove, near El Dorado, Ark., for production of synthetic ammonia and ammonium nitrate. It will be operated under lease arrangement by Lion Oil Refining Co., El Dorado, which has organized Lion Chemical Corp., a subsidiary, for that purpose. It will be known as Ozark Ordnance Works, and will include processing and production units, natural gas supply lines, machine shops and other structures. Cost about $23,000,000.

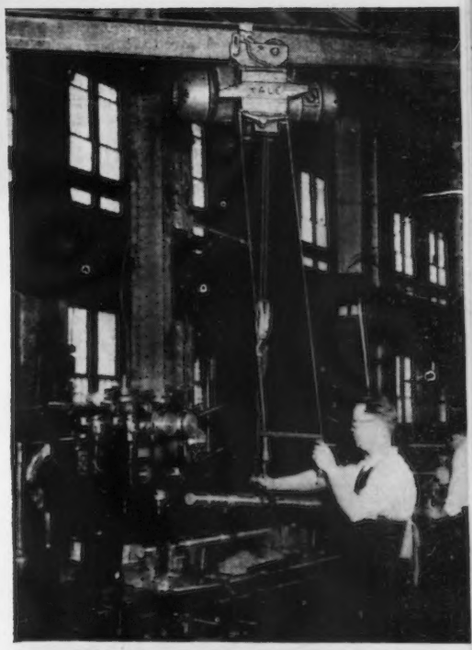
City Council, Sebring, Fla., has plans for extensions and improvements in municipal power plant, including new generator unit and auxiliary equipment. Cost about $130,000, of which $65,000 will be secured through Federal aid.

City Council, Bowling Green, Ky., G. T. Carmichael, chairman, defense committee, plans hangar with repair and reconditioning shops, oil storage and distributing building, and other facilities at new municipal airport in Warren County, where about 39 acres is being secured. Cost about $332,000. Fund in that amount has been arranged through Federal aid.

Swift & Co., Fertilizer Division, Union Stock Yards, Chicago, and Murchison Building, Wilmington, N. C., has let general contract to W. A. Simon, 309 Marstellar Street, Wilmington, for one-story addition, about 140 x 225 ft., to local plant for expansion, with part of structure for storage and distribution. Cost close to $85,000 with equipment.

Tennessee Copper Co., Inc., Copperhill, Tenn., will begin work at once on new plant near present works, for which contract was awarded recently to Leonard Construction Co., 37 South Wabash Avenue, Chicago. It will





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To increase hoisting efficiency, cut costs and help speed production, install Yale Hoists for your every hoisting job. Yale Hoists are backed by nearly 75 years of manufacturing experience, are built to last, give top performance day-in and day-out, under the most rigorous conditions.

The Ball-Bearing Spur-Geared type of Hoist (above) was originated and pioneered by Yale. It has the highest lifting efficiency ever achieved in a hand chain hoist. Among its many advantages are self-actuating load brakes, safety load hooks and friction-minimizing steel load chain.

Yale "Cable King" Wire Rope Electric Hoists (top right) are the only electric hoists to incorporate air-cooling as an integral part of their design. Air-cooling permits them to work on heavier duty cycles, since it eliminates excessive brake heat. Portable "Pul-Lift" Hand Hoists (lower right) fit in on almost any job. Inasmuch as they work in either vertical or horizontal position, they can be used for both pulling and lifting. You can't corner these hoists, either. Ratchet handle operates at any point within a complete circle.

Get in touch with your nearest Yale distributor today. Let him show you how Yale Hoists can increase the efficiency of your hoisting operations.

Spur-Geared Hand Chain Hoists Capacities: 300 lbs. to 40 tons. Electric Hoist Capacities: 1/4 to 10 tons. Portable "Pul-Lift" Hoist Capacities: 3/4, 1 1/2, 3, 4 1/2 and 6 tons.

THE YALE & TOWNE MANUFACTURING CO.

PHILADELPHIA DIVISION—PHILADELPHIA, PA., U. S. A. IN CANADA: ST. CATHARINES, ONT.

Dept. D

TRADE YALE MARK

World's oldest and largest makers of Materials Handling Equipment, including Hand and Electric Hoists, Hand Lift Trucks, Electric Industrial Trucks and Tractors, Skid Platforms, and allied products.

consist of several one and multi-story units for production of oleum (fuming sulfuric acid) for government, and will be known as East Tennessee Ordnance Works. Output will be used in manufacture of TNT at Volunteer Ordnance Works of government at Chattanooga, Tenn. Cost about $3,340,800, fund in that amount to be secured from Defense Plant Corp., Washington.

Texas Pipe & Supply Co., 1720 Maury Street, Houston, Tex., pressure pipe, oil well supplies, etc., plans one-story addition, 30 x 150 ft. Cost close to $40,000 with equipment. Lenard Gabert, 1315 Bell Street, is architect.

General Metals Corp., Liberty Road, Houston, Tex., forgings, etc., has let general contract to Peden Iron & Steel Co., 700 North San Jacinto Street, for one-story, sawtooth-type addition, for expansion in forge and die shops, and inspection division. Cost over $125,000 with equipment. Main offices are at 701 105th Avenue, Oakland, Cal.

Central States

● **Bishop & Babcock Mfg. Co.,** 4901 Hamilton Avenue, Cleveland, bottlers' machinery and kindred equipment, will take bids at once on general contract for one-story addition, 30 x 170 ft., for a furnace building, with hardening furnace units, quenching pits and auxiliary equipment. Cost over $85,000 with equipment. W. S. Ferguson Co., 2362 Euclid Avenue, is architect.

American Fork & Hoe Co., Keith Building, Cleveland, has let general contract to Ashtabula Industrial Corp., Ashtabula, Ohio, for one-story addition to branch plant at Ashtabula. Cost close to $60,000 with equipment.

Denison Engineering Co., 119 West Chestnut Street, Columbus, Ohio, presses, pumping machinery and allied equipment, has let general contract to Y. & Y. Construction Co., 328 East Town Street, Dayton, Ohio, for one-story addition to local plant. Cost close to $45,000 with equipment.

Rural Electric Co-operative, Inc., Jackson, Ohio, plans new steam-electric generating plant for power supply for rural lines in that area. Cost about $250,000 with equipment. Financing in that amount has been arranged through Federal aid.

Steel Improvement & Forge Co., 950 East Sixty-fourth Street, Cleveland, steel forgings, will begin superstructure soon for one-story addition, about 60 x 170 ft. Cost over $65,000 with equipment. General contract was let recently to J. L. Hunting Co., Ninth-Chester Building. Wallace H. Hatch, Hippodrome Building, is architect.

Emery Industries, Inc., Carew Tower Building, Cincinnati, acids, chemicals, etc., has let general contract to Meyer-Hecht Co., 2834 Stanton Avenue, for one and three-story addition to plant at St. Bernard, Ohio, 65 x 156 ft. Cost over $100,000 with equipment. Tietig & Lee, Inc., 34 West Sixth Street, is architect.

Colonial Iron Works Co., 17643 St. Clair Avenue, Cleveland, iron and steel products, plans one-story addition, about 75 x 120 ft. Cost close to $50,000 with equipment.

General Electric Co., Schenectady, N. Y., is erecting one-story plant, main unit about 700 x 800 ft., at Fort Wayne, Ind., to be operated in conjunction with Fort Wayne Works, M. E. Lord, manager, for production of turbo-superchargers for airplanes, including parts manufacture and assembling. Output will be for government, which will provide funds of about $24,000,000. Of this amount about $16,000,000 will be used for machinery and other equipment.

Delco-Remy Division, General Motors Corp., Anderson, Ind., automotive starting and lighting equipment, plans expansion for production of aircraft equipment for government. Machinery installation will cost about $378,100, fund in that amount to be furnished by Defense Plant Corp., Washington.

Falstaff Brewing Corp., 3684 Forest Park Boulevard, St. Louis, has asked bids on general contract for one-story addition, 78 x 107 ft., to branch plant at 2800 Gravier Street, New Orleans, for fermenting department, storage and distribution. Cost over $65,000 with equipment.

Omar Tool & Machine Co., 1828 North Seventeenth Street, St. Louis, has let general contract to H. Kissel's Sons, 4107 West Florissant Avenue, for new one-story plant, 75 x 150 ft., at Palm Street and Natural Bridge Avenue. Cost over $65,000 with equipment. C. G. Weinel, 6635 Delmar Boulevard, University City, Mo., is architect.

Killark Electric Mfg. Co., 3940 Easton Avenue, St. Louis, conduit fittings, fuses and other electrical equipment, has let general contract to Hercules Construction Co., 8808 Ladue Road, Clayton, Mo., for one-story addition, and improvements in present plant. Cost close to $45,000 with equipment. Johnson & Maack, 705 Olive Street, are architects.

Aluminum Co. of America, Inc., 3311 Dunn Road, Detroit, has let general contract to A. R. Crow Co., 14341 Schaefer Street, for one-story addition and improvements in present plant. Cost over $50,000 with equipment. Main offices are at Pittsburgh.

Reichold Chemicals, Inc., 601 Woodward Heights Boulevard, Detroit, has let general contract to Cunningham-Rudy Co., 3087 West Grand Boulevard, for one-story addition. Cost close to $100,000 with equipment.

Genesee Tool Co., Fenton, Mich., cutting tools, etc., plans expansion for production of ordnance equipment for government, including equipment to cost about $154,000. Fund in that amount will be furnished by Defense Plant Corp., Washington, for project.

Air Control Products, Inc., Muskegon, Mich., registers, grills, air-control apparatus, etc., has purchased former plant of Pet Milk Co., Coopersville, Mich., and will remodel for branch works for production of aircraft parts for government.

Continental Motors Corp., 12801 East Jefferson Avenue, Detroit, gas and gasoline engines, parts, etc., will begin work soon on new one-story plant, 320 x 680 ft., near present works at Muskegon, Mich., for production of aircraft engines for government. General erection contract was let recently to J. A. Utley, 723 East Ten-Mile Road, Royal Oak, Detroit. Cost over $700,000 with equipment.

Michigan Public Service Co., Traverse City, Mich., plans new power plant at Montague, Mich., for auxiliary service, including diesel engine-generator units and auxiliary equipment. Cost about $200,000 with transmission lines, switching station and other facilities.

Hercules Powder Co., Delaware Trust Building, Wilmington, Del., has contracted with War Department, Washington, for new powder mill and acid plant at Sumpter, near Merrimack, Wis. It will include multi-story production units, machine shops, power house, pumping station and other structures. Cost estimated at $65,000,000, of which about $23,000,000 will be used for equipment, and $42,000,000 for buildings. Fund in gross amount will be furnished by Defense Plant Corp., Washington. Plant will be known as Badger Ordnance Works.

United Drill & Tool Corp., 411 West Ontario Street, Chicago, plans new local plant for manufacture of ordnance equipment for government. Cost about $1,942,700, financing to be provided by Defense Plant Corp., Washington.

A. O. Smith Corp., 3533 North Twenty-seventh Street, Milwaukee, will take bids soon for one-story steam power house, 80 x 100 ft., in connection with plant expansion now under way. Cost over $75,000 with boiler units and auxiliary equipment. E. W. Burgess is company engineer.

American Steel & Wire Co., 208 South LaSalle Street, Chicago, will begin work soon on one-story additions to branch plant at North Chicago for expansion in wire-weaving and chain link departments. General erection contract has been let to Sumner S. Sollitt & Co., 307 North Michigan Avenue. Cost close to $265,000 with equipment.

Globe Shipbuilding Co., Superior, Wis., plans expansion for building vessels for U. S. Maritime Commission, to include new shop units and equipment. Cost about $175,000, Defense Plant Corp., Washington, to provide fund for project.

Western States

● **Bureau of Yards and Docks,** Navy Department, Washington, has let general contract to Henry J. Kaiser Co., Latham Square Building, Oakland, Cal., for five new double shipways and one-story shops at Mare Island Navy Yard, Vallejo, Cal., on bid of $5,624,000, exclusive of equipment.

Allied Engineering & Shipbuilding Corp., 416 West Eighth Street, Los Angeles, plans extensions and improvements in shipyard at National City, Cal., for production of concrete barges for government, to include two shipways, shops, warehouses and other structures. Cost close to $500,000 with equipment. Financing will be arranged through Federal aid.

United States Engineer Office, Old Post Office Building, Sacramento, Cal., will complete plans soon for mechanics' school at airport at Stockton, Cal., including three one-story motor instruction and repair shops, similar mechanical shop for reclamation and salvage, and other structures. Facilities will be provided for about 600 men. Cost reported over $650,000.

Lockheed Aircraft Corp., Burbank, Cal., has leased plant of Willys-Overland Motors, Inc., at 6201 Randolph Street, Los Angeles, for expansion. Willys-Overland company will concentrate automobile production at Toledo, Ohio.

Bureau of Reclamation, Denver, asks bids until Dec. 17 for 14 102-in. conduit tube valves for installation in river outlets at Shasta Dam, Central Valley project, Cal. (Specification 1016).

Pacific Paint & Varnish Co., 1612 Fourth Street, Berkeley, Cal., paints, varnishes, oils, etc., will begin superstructure for one-story addition for storage and distribution, for which general contract recently was let to E. R. DeChene, 424 Sixtieth Street, Oakland, Cal. Cost about $50,000 with equipment.

Canada

● **Cleveland Pneumatic Tool Co. of Canada, Ltd.,** 7 Millwood Avenue, Leaside, Ont., will begin superstructure soon for one-story addition, about 40 x 125 ft., for which general contract recently was let to Thomas McClintock, 120 Floyd Street, Toronto. Cost over $50,000 with equipment. H. D. Martin, 59½ Hopedale Avenue, Toronto, is architect.

Department of Munitions and Supply, Ottawa, Ont., will take bids soon on general contract for one-story addition to Central Technical School, Lippincott and Harbord Streets, Toronto, for an aircraft department, operated under direction of National Defense for Air, Ottawa. Cost over $200,000 with equipment.

Canadian Westinghouse Co., Ltd., Sanford Avenue North, Hamilton, Ont., has begun work on three-story addition, 30 x 100 ft., for which general contract recently was let to W. H. Yates Construction Co., Ltd., 400 Wellington Street North. Cost over $85,000 with equipment.

Aluminum Co. of America has given up its exclusive rights to its registered trademark "Alclad," in the interests of the National defense program. "Alclad" materials, principally aluminum sheet, are widely used in aircraft construction. Other aluminum producers are now making similar duplex materials ultimately destined for government use, and may use the name "Alclad" as a convenient means of identification.

Freyn Engineering Co., Chicago, has been awarded a contract to build a new 1300 net ton blast furnace in the Middle West, including the reconstruction of four stoves.